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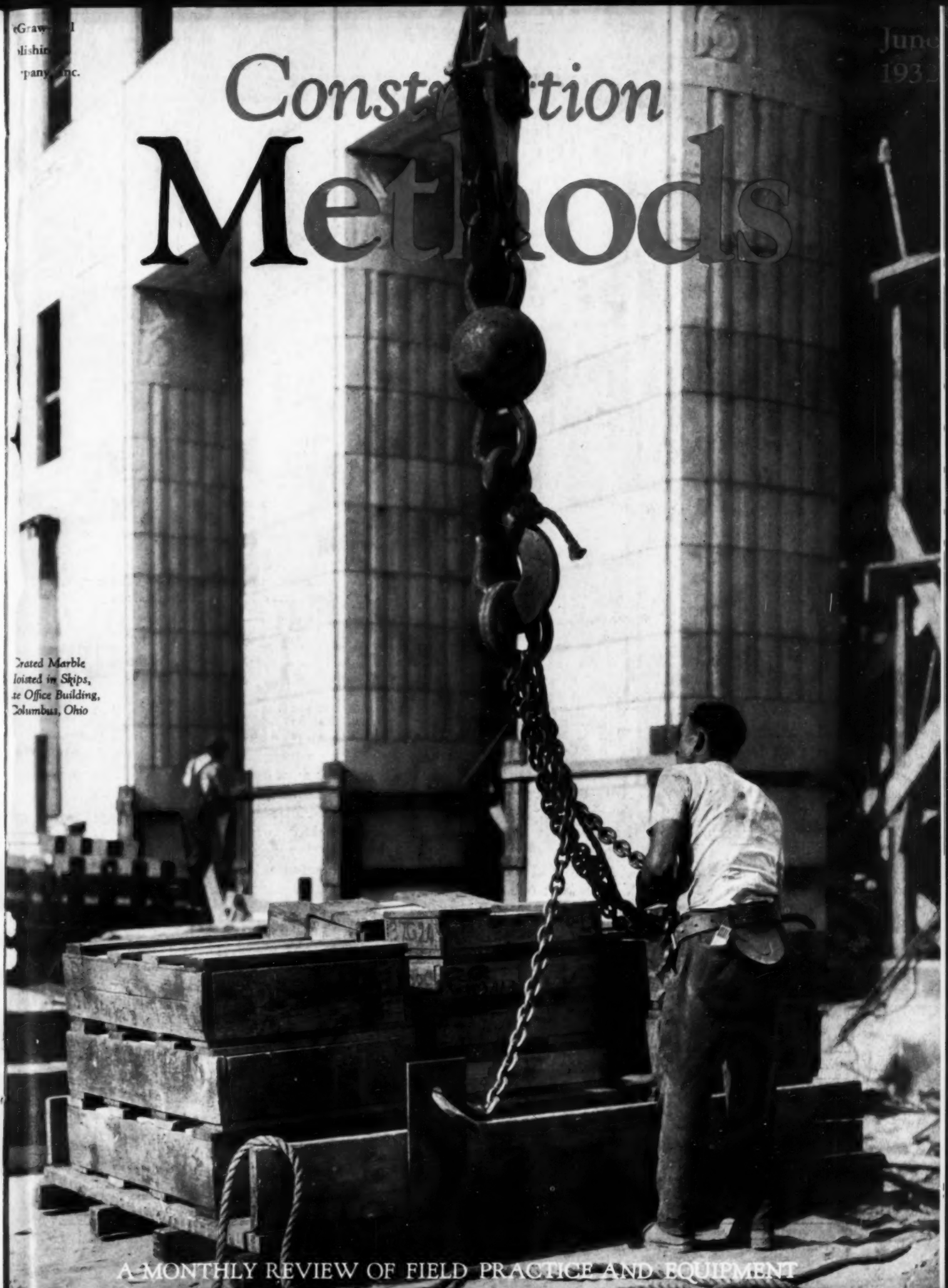
Construction Methods



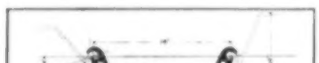
Crated Marble
loisted in Skips,
te Office Building,
Columbus, Ohio

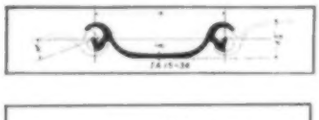
A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

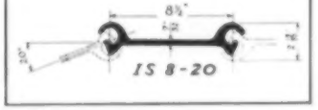
2500′ cofferdam—Easterly Sewage Treatment Works, Cleveland, Ohio—constructed by the American Construction Co., Cleveland. A substantial portion of the sheet piling used is Inland Section ID 16-25. Men shown in picture are standing 14′ below mean lake level. All of the water is coming out of the bank. The contractor reports: "We feel that it is remarkable that in a cofferdam of this length, there is no evidence of leakage at any point."

More and More Contractors Using INLAND SHEET PILING

Other Sections Will Be Added Soon







Section No.	Width	Lbs. per Sq. Ft. of Wall
ID 16-25	16″	25.00
ID 16-32	16″	32.00
IA 15-34	15″	34.00
IS 8-20	8½″	20.74

HERE is the record of a new Inland product which rendered satisfactory service from the start and has met with constantly growing popularity:

Inland Steel Sheet Piling was introduced about one year ago. The very first installation—made by contractors of nation-wide note—was highly successful. Since then many other leading contractors have convinced themselves by use that Inland Sheet Piling is right in every detail. Projects incorporating Inland Sheet Piling include many of the most important of the year.

Driving is fast and trouble-free. The interlock has proved its strength and tightness on "tough" installations. The quality is assured by Inland's practice of minute checking at every turn. And the engineering service to which an inquiry entitles you is complete in every detail.

Take advantage of Inland quality and Inland services on your next sheet piling installation. INLAND STEEL COMPANY, 38 So. Dearborn St., Chicago, Ill.

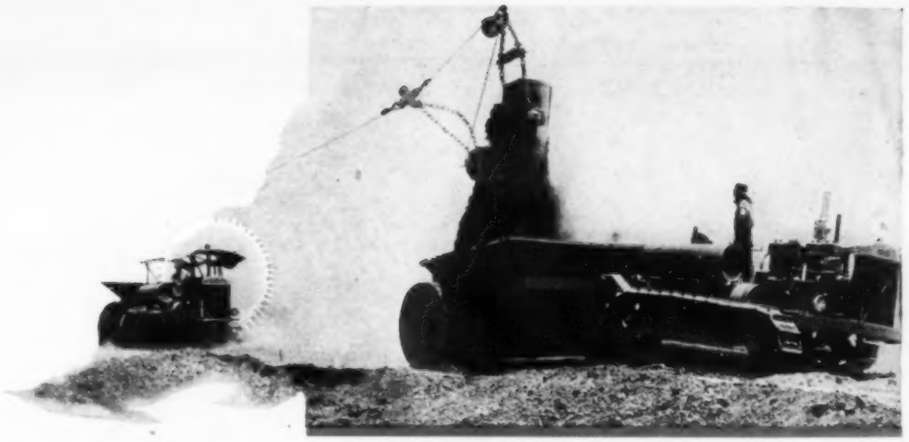
INLAND STEEL

ABLE SERVANT OF THE CENTRAL WEST

Sheets Strip Plates Rails Track Accessories
Bands Structurals Piling Bars Rivets Billets

CONSTRUCTION METHODS, June, 1932. Vol. 14, No. 6. Published monthly. McGraw-Hill Publishing Company, Inc., 330 West 42d Street, New York, N. Y. $1 per year. Central and South American countries and Foreign, $2 U. S. Currency, or 10 Shillings. Canada (including Canadian duty), $1.50. 10 cents per copy. Entered as second-class matter, October, 1926 issue, Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

The Editor Notes -



Construction Hazards

NO MORE tragic example of the unpredictable hazards that attend construction can be found than the devastating explosion which took ten lives in the almost completed Ohio state office building at Columbus on the afternoon of April 14. It seems a particularly malicious turn of fate which could thus single out a job marked from its beginning by the greatest care in anticipating every known construction hazard. As described on pp. 20-24 of this issue, the general contractor and his safety engineer exerted every means to protect the workers from accident. A severity rate of less than 1.5 apparently was to be the just reward of their determined effort.

In an instant the result of their labors was destroyed, the building shattered, men's lives snuffed out. An explosion from a source unsuspected then and undetermined today wreaked havoc where they had worked for order and security, taking the life of the superintendent who had directed the job from the start.

The fatal accident detracts nothing from the effort that had gone before. Enough had been gained to demonstrate the worth of the safety campaign. Rather, the explosion brings home more sharply to constructors a realization of the hazards of their calling. It should inspire them to an ever keener and closer vigilance.

Pavers Operating in Parallel

Experience in operating two paving mixers in parallel is offered by the construction of the 40-ft. wide Dunes relief highway in Indiana. As recounted in more detail on pp. 32-35, the overall efficiency of the plan was reduced by parallel operation, but the saving in payroll expense was sufficient to cause the contractor to favor this method. The number of puddlers and finishers, except in the hottest weather, was no greater than that needed for each mixer when operating separately. Likewise, the labor required for curing concrete and moving forms was about the same for the two pavers in parallel as it would have been for one mixer operating individually. On the water line feeding the pair of mixers, of course, work was practically halved.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

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330 West 42d St., New York, N. Y.

Building a Replica of Federal Hall

To build for the future is the constructor's usual objective. In direct contrast with this practice was the job of building for the past, involved in producing a replica of the colonial structure in which the first President of the United States took the oath of office. The story of how Federal Hall was reproduced in a park in midtown New York as a setting for the George Washington Bicentennial ceremonies is told on pp. 28-30. The design involved a great amount of research, including search of historical records and examination of numerous old prints in order that the building, in outward appearance, should be a faithful facsimile of the original.

Speedy construction had to be resorted to in order to finish the building in time for reenacting the inaugural ceremonies. The contractor, in completing the job in 31 working days, made effective use of timber construction. An interesting detail was the method and the materials involved in reproducing in plaster the ornamentation of the original Federal Hall. Flexible molds, of a special glue composition, facilitated this part of the work. The job is an example of the constructor's resourcefulness in adapting methods and materials to an unusual purpose.

Steel Face Makes Dam Watertight

WITH the object of producing an absolutely watertight structure, the designers of the rockfill dam for supplying additional water to the Broadmoor Hotel at Colorado Springs, Colo., have introduced a decidedly novel feature in the form of a diaphragm of arc-welded steel plates covering the entire upstream face of the structure. As described on pp. 40-41 of this issue the dam is 580 ft. long on top and 100 ft. high from the bottom of the toe wall to the crest. For the construction man the interesting features of the project are the methods employed in placing the steel plate facing and preventing leakage through its joints. Briefly, the 20x8½-ft. steel plates forming the diaphragm were assembled by loose bolting until three rows of plates had been connected up. The top of the loosely bolted section of facing was then swung out from the face of the dam a sufficient distance to allow workmen to be lowered behind it to hold the bolts while workers on the outside set up the nuts tightly. When this operation had been completed for a section eight rows in length, all joints and bolt heads were made watertight by arc welding. Expansion joints are introduced in the steel plate facing at intervals of 40 ft. 7 in. for the full length of the dam.

While electric welding has ceased to be a novelty in pipe line work or on bridge or building construction, its employment on an extensive scale in the construction of a dam is an innovation.

Better Selling through Better Buying

DURING the last couple of years we have heard a lot about unsound selling methods — extravagant price cutting, demoralizing credit terms, camouflaged concessions and other destructive trade tactics.

Legitimate manufacturers who have invested in their products a wealth of scientific research to insure their basic merit, who have built efficient plants and organizations to achieve quality production as well as quantity production and who have so managed as to conserve steady employment at fair wages for high-grade workers have fought consistently against those practices that have tended to destroy the values they have labored so conscientiously to maintain.

But the preservation of trade standards is not the affair of the manufacturer alone; it concerns even more vitally the user of his products. The manufacturer might still be able to show a profit, for a time anyway, by making and selling inferior and shoddy goods. But it is the user whose work must stand or fall by the quality of the materials or equipment he builds into his structures or his plant. It is he who must pay in unsatisfactory service, costly maintenance or wasteful replacement, the penalty for any questionable compromise between trustworthy quality and a few dollars of saving in first cost.

We hold no brief for gouging or excessive prices, artificially maintained. But in times like these it is difficult to imagine any reputable manufacturer risking the loss of a market or of a hard-won standing in his field for the sake of an unconscionable profit. More likely he is struggling desperately to hold them and at the same time to conserve the reputation of his product, even at the cost of reduced or vanishing profits. And by his success in that effort the entire industry that he serves will be the gainer.

For every unsound sale there must be an unsound buy. So it may be worth while to shift the emphasis now and then from *unsound selling* to *unsound buying*. The seller can do but little to remedy destructive selling practices; he must meet the competitive conditions imposed by the buyer. But the buyer can do a great deal.

So when the engineer or the contractor is buying in these parlous times it is the more incumbent upon him to buy soundly, to avoid unfair shopping of bids, to balance values as well as prices, to be sure that he gets what he specifies, to be willing to pay a fair price for an honest product or service. His objective should be to buy neither cheaply nor extravagantly, but always economically. Sound buying methods will help materially to eliminate unsound selling methods.

And it is well to remember the maxim than "no product ever has been made that could not be made worse and sold for less."

Willard Chevalier

Publishing Director

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21% STRONGER HANDLE

3 Ounces Lighter Shovel

ACHIEVED BY ADDING THE A B W SHOCK BAND TO THE A B W SOLID SHANK LINE

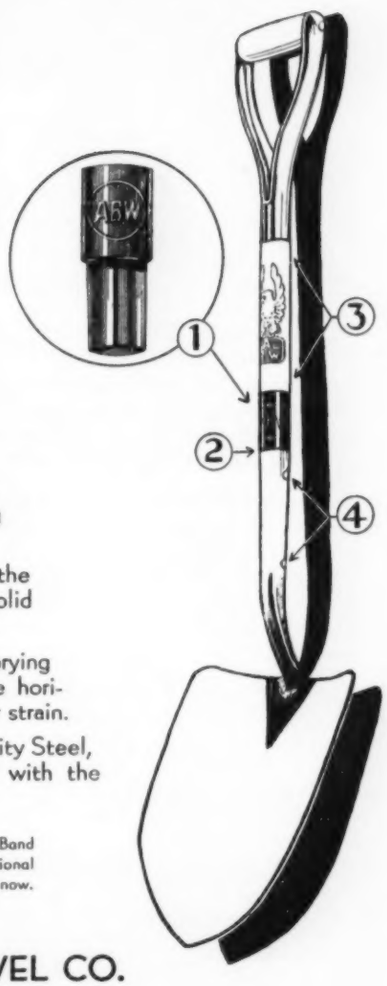
- This development means greater strength, less weight, increased toughness and better balance, giving A B W the greatest line of One-Piece Solid Shank Shovels ever made! Check these four points and you'll realize why!

1 The Shock Band is mounted (under pressure), around the handle at the point of greatest strain between the handle and shovel socket. Result 21% stronger handle.

2 We have welded top of socket preventing its spreading and opening under prying strain. Shoulder of socket meets shock band, eliminating the cutting of the wood so common in the ordinary shovel.

3 The Shock Band in combination with the Armor-D handle reduces the exposed wood section of the handle stem to 6". (The average Solid Shank Shovel has 11".)

4 Rivets are inserted horizontally instead of perpendicularly. In a prying strain, the top and bottom wood fibres are under pressure. The horizontal rivets therefore do not reduce the strength of fibres under strain.



One-piece Blade, Shank and Socket forged from high carbon quality Steel, heat-treated. Handles are selected Northern Ash, equipped with the famous Armor-D handle.

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BRONCO
PONY
HUSKY
PACEMAKER
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GOLD BUG

A complete line of "A B W" Solid Shank Shovels equipped with A B W Shock Band ready for immediate delivery. Shock band is standard equipment at no additional cost to you. Forecasting a large demand, we suggest you place your orders now.

ASK YOUR JOBBER

AMES BALDWIN WYOMING SHOVEL CO.

PARKERSBURG, W. VA.

PROGRESS

OR

Laissez faire?

TODAY every manufacturer is on trial before the bar of progress. Manufacturing technic must either progress or retrogress. Nothing can stand still and live. Everything grows or stagnates . . . and this applies to ideas as well.

Because our forefathers made wire rope in a certain way is not proof that there is no better way to make wire rope. Until the last decade, internal stress in wire rope was accepted as an unavoidable evil . . . side-stepped, so to speak, because no cure for internal stress had been discovered.

The basic process of preforming the strands and wires to the exact shape they assume in the rope structure proved beyond doubt the fallacy of the idea that wire rope had to be made as our forefathers made it.

Tru-Lay Preformed Wire Rope is gaining new adherents every day of the year, for the sensible reason that Tru-Lay gives increased service which *averages* between 30% and 300% over non-preformed wire rope of the same grade and construction.

Here is another example of *progress* versus "let well enough alone." If you are interested in operating economy of wire rope, let us give you the facts about Tru-Lay Preformed Wire Rope. Address:

AMERICAN CABLE COMPANY
Incorporated
New York Central Bldg., 230 Park Avenue
New York, N. Y.

District Offices: Atlanta, Chicago, Denver, Detroit, Philadelphia, Pittsburgh, Tulsa, San Francisco

An Associate Company of the American Chain Company, *Inc.*

Only in Preformed Wire Rope will the strands and wires stay in position without seizing the end . . . as revealed in this actual unretouched photograph

TRU-LAY *Preformed* WIRE ROPE

30% to 300% *Increased Service* { *Depending upon the character of the service and type of equipment*

NORTHWEST

any speed at the touch of a lever!

VARIABLE SPEED MOTOR *Accelerator Controlled*

Faster digging—
With the Variable Speed Motor, accelerator controlled, the operator has any speed at his finger tips. In light soil, friable material or in shallow cuts he speeds up far above governed speed without leaving his seat.

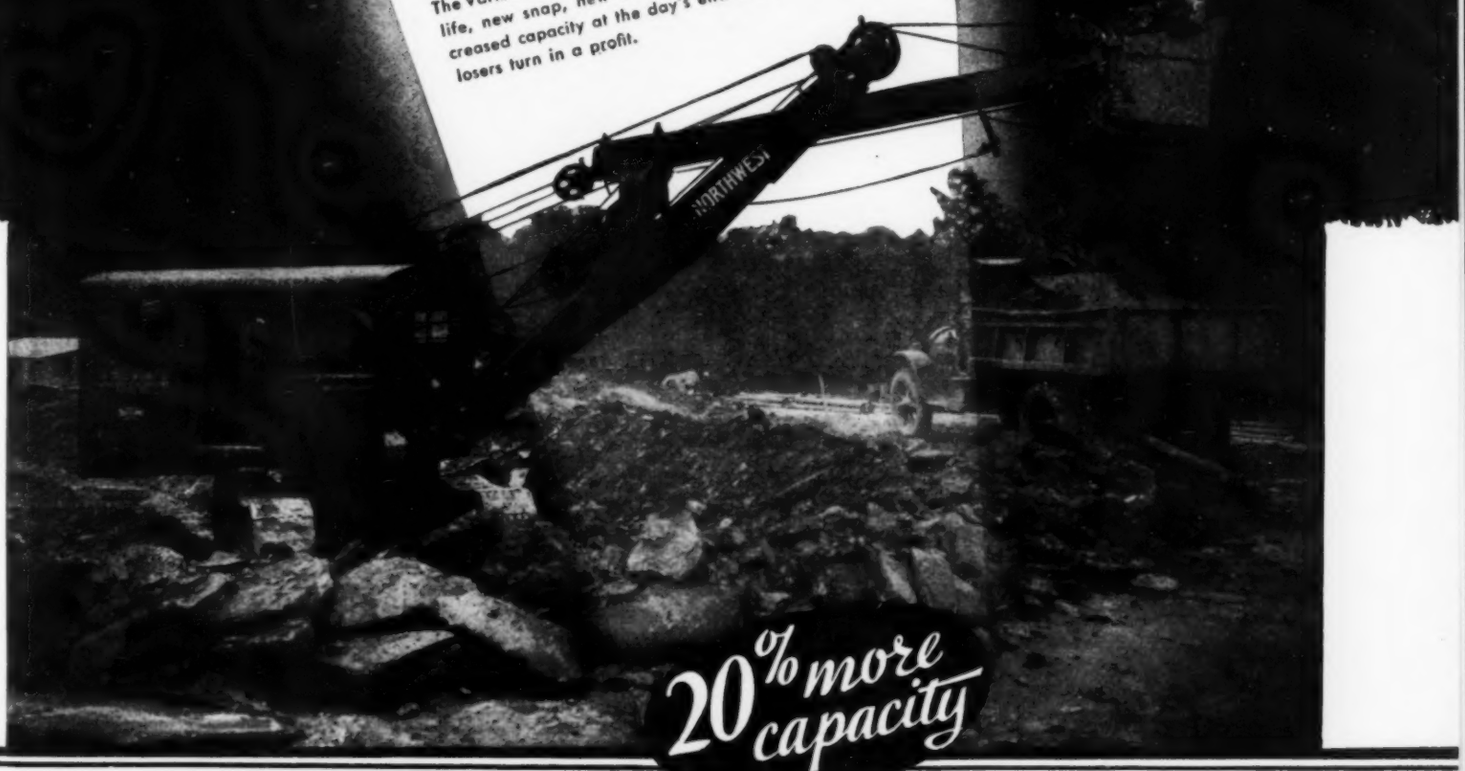
Faster swing—
The Variable Speed Motor makes possible rapid acceleration on the swing, materially reducing the time normally lost in this operation.

Faster return of the dipper—
The swing complete, the dipper is returned to the cut at high speed and the cut is started again in a quarter of the time required by the usual governor controlled engine.

Faster travel—
Traveling to the job and maneuvering for a change of cut are done at speeds impossible for the engine that is governor controlled. In easy going the throttle is wide open at the touch of a lever. In heavy soil or mud you have the full power of the slow governed speed with positive traction on both crawlers at all times.

Faster operation—
The Variable Speed Motor, accelerator controlled, brings new life, new snap, new action to operation. The result is increased capacity at the day's end and jobs that look like losers turn in a profit.

NORTHWEST SHOVEL—AMERICA'S LEADING ROAD BUILDER



20% more capacity

NORTHWEST ENGINEERING COMPANY

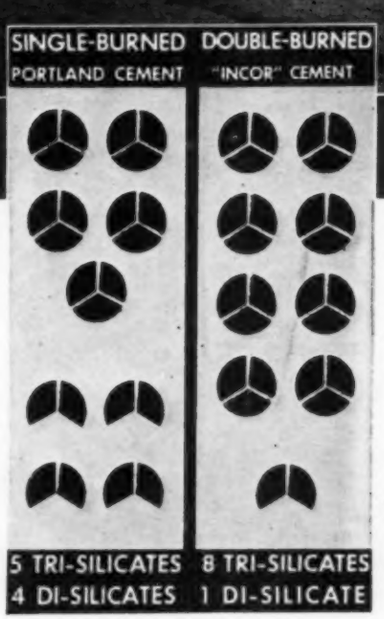
The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1798 Steger Building

Public Saves $2,000

THURS.— CONCRETE POURED

FRI.— READY FOR TRAFFIC



How 'Incor' Differs

Diagram at right shows difference between ordinary Portland cement and 'Incor'.

All cements are composed of *tri*-calcium silicates and *di*-calcium silicates. *Tri*-silicates are active. *Di*-silicates, sluggish.

The double-burning process of producing 'Incor' minimizes slow-hardening *di*-silicates, increases active *tri*-silicates. That is why 'Incor' hardens ten times as fast.

Contractor Profits by Continuous Operation

Detour Eliminated While Paving Highway Gaps

WHEN the Alabama State Highway was improved between Birmingham and Tuscaloosa, several deep fills were not paved, because settlement was anticipated. Some of these gaps were a quarter of a mile long.

When subgrade became stable, the problem of how to repave the widely separated gaps arose.

The best available detour was three miles longer than the main road,—hilly, rough and dusty.

Traffic operation costs were analyzed. The use of the detour would have cost the motoring public $5,400 in operating expense and lost time —$15 per day, in maintenance.

Half-width construction was ordered—traffic routed through the job. Had ordinary Portland cement been used in the first lane, equipment would have lain idle or been moved over long distances, only to return later to complete the second lane when the first was ready for traffic. Meanwhile one-way traffic would have been maintained over the subgrade for ten days. This meant traffic interference, delay and needless expense.

Engineers found a better solution. 'Incor' 24-Hour Cement was specified.

By using 'Incor' in both lanes, the contractor began paving the second lane after a single day's delay. Twenty-four hours after paving, the entire job was open to traffic. Equipment progressed through the job.

In the final analysis, it is the motoring public that pays for the cost of idleness. It must be reflected in bid prices. In addition, barricades to traffic and restricted roadway width frequently result in serious accidents.

By making it possible to end 60% to 80% of all detours, 'Incor' offers savings of over $240,000,000 yearly to the taxpaying, motoring public.

The economies of 'Incor' are applicable to all types of work where concrete is used. Let an 'Incor'* man answer your questions—show you the basis for estimating savings. Ask your nearest Lone Star Company for this service.

*Reg. U. S. Pat. Off.

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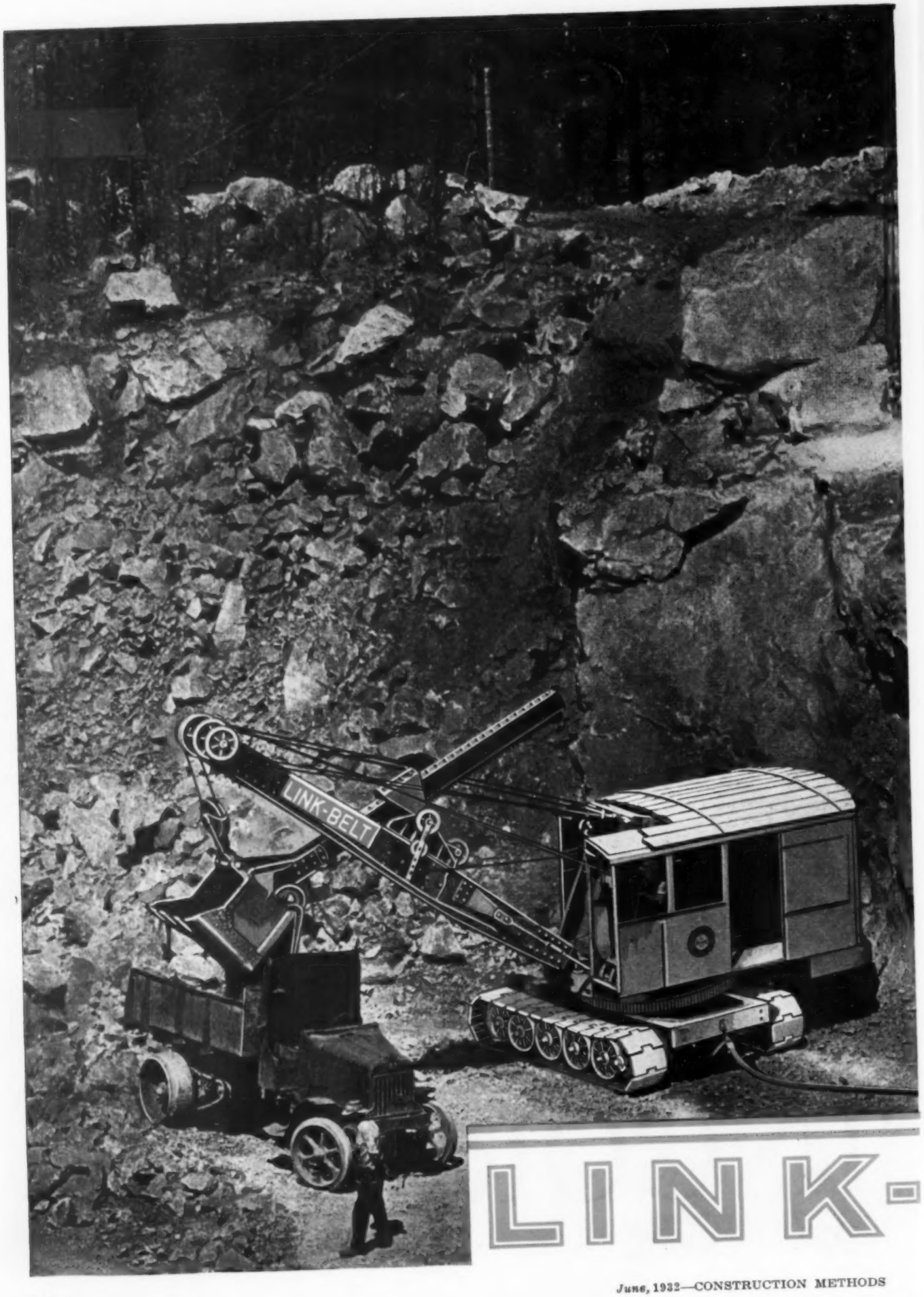
Lone Star Cement Co. Virginia, Inc.....Norfolk

'INCOR' 24-Hour Cement

PROVEN BY 5 YEARS' USE

'INCOR' is made by the producers of Lone Star Cement, subsidiaries of International Cement Corporation, under Patent Nos. 1,700,032 & 1,700,033



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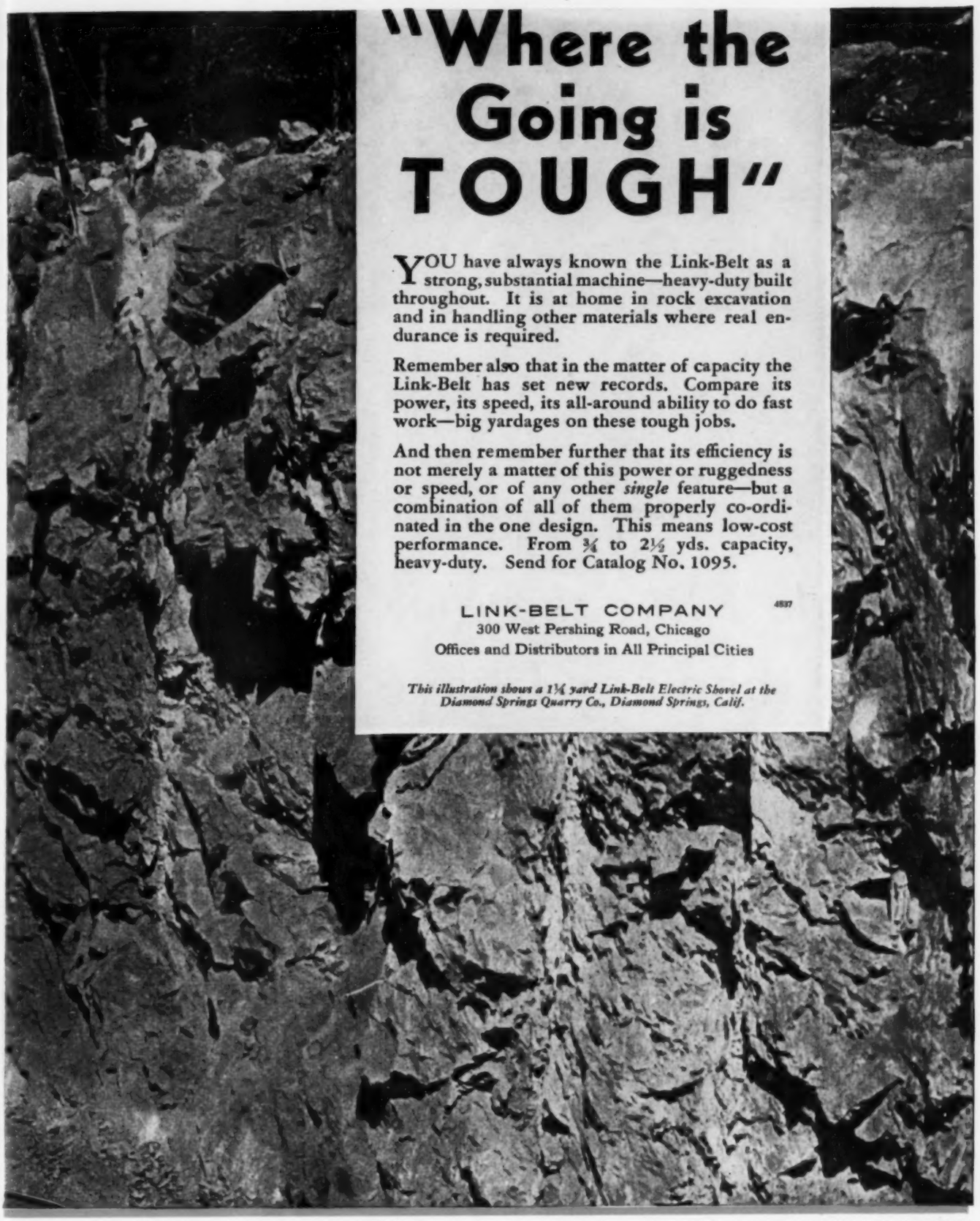

"Where the Going is TOUGH"

YOU have always known the Link-Belt as a strong, substantial machine—heavy-duty built throughout. It is at home in rock excavation and in handling other materials where real endurance is required.

Remember also that in the matter of capacity the Link-Belt has set new records. Compare its power, its speed, its all-around ability to do fast work—big yardages on these tough jobs.

And then remember further that its efficiency is not merely a matter of this power or ruggedness or speed, or of any other *single* feature—but a combination of all of them properly co-ordinated in the one design. This means low-cost performance. From ¾ to 2½ yds. capacity, heavy-duty. Send for Catalog No. 1095.

LINK-BELT COMPANY 4837
300 West Pershing Road, Chicago
Offices and Distributors in All Principal Cities

This illustration shows a 1¼ yard Link-Belt Electric Shovel at the Diamond Springs Quarry Co., Diamond Springs, Calif.

LINK-BELT SHOVEL-
CRANE-
DRAGLINE-

"How do I like the New G-E Welder?
Better than any I have ever used!"

THE NEW
G-E ARC WELDER

Combines and excels all the best features of all the good welders now on the market... plus new features all its own.

1. Stable, flexible arc
2. Quick recovery ("pep")
3. Self-excitation
4. Spark-free commutation
5. Simple operation
6. Duplex voltage control
7. Dead-front control panel
8. Large, protected instruments
9. Light, compact, strong construction
10. Low center of gravity
11. A definite purpose for every ounce of material

The operator, who is kept busy on repair work in a Mid-Western cement plant, was enthusiastic.

"It sure is a real set. Easy to handle; easy to haul around; holds a steady arc; puts the metal on just the way you want it. She's 100 per cent O.K."

If you are skeptical of testimonials and claims, we hope you will ask your welding distributor or nearest G-E office for a demonstration. Compare the new G-E arc welder with any other welder on the market. While you are investigating this set, ask also about the complete G-E line of welding electrodes and accessories.

530-130

GENERAL ELECTRIC


The Grader

You Need — — —

Austin-Western sells it—graders for road maintenance, graders for construction, horse drawn patrols, planers, light blade graders, heavy blade graders, motor graders with single, tandem and full-dual drives, graders of every type, graders for every job!

The Austin-Western Line is complete (a few models are illustrated), offering a size and type to meet every demand, with accessories and attachments to suit every operating requirement.

Mechanical refinements, dictated by seventy-four years of specialization, provide correct operation, even by unskilled operators; in-built ruggedness assures a full measure of service; warehouse stocks in twenty-seven cities assure prompt delivery —these are added reasons for you choosing an Austin-Western Grader.

Investigate the Austin-Western Line first—get first hand data from our sales engineers—get the facts and then make your comparisons. Unit for unit Austin-Western machines are better built for harder service, rougher handling AND longer life. A call for a sales engineer implies no obligation. Bulletins on one type of grader or the complete Austin-Western Line, too, are gratis—write for copies today!

The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, Ill.

Austin-Western should be your buying source for road building and maintenance, rock crushing and earth handling equipments, for maximum service, and a faster, better finished job must result from the use of properly designed, inter-related machines.

The Austin-Western Line includes many models of

CRUSHING and SCREENING PLANTS
SWEEPERS and SPRINKLERS
ROAD ROLLERS • BITUMINOUS DISTRIBUTORS
CULVERTS • ROAD DRAGS
BLADE GRADERS • MOTOR GRADERS
ELEVATING GRADERS • PLOWS and SCRAPERS
CRAWLER SHOVELS
CRANES and DRAGLINES
CRAWLER and DRUM WHEEL WAGONS
ROOTERS, SCARIFIERS and MISCELLANEOUS
SMALL TOOLS

337

The Austin-Western ROAD MACHINERY CO.

ROAD ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS, SWEEPERS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS. MOTOR GRADERS, PLOWS & SCRAPERS, ROAD OILERS, ROAD DRAGS, CULVERTS, SHOVELS & CRANES, DUMP WAGONS, SNOW PLOWS.

THE VULCAN "PUNCH"

Warrington Vulcan Pile Hammers have been known for their "punch." They have the real driving power that pounds in the piles at record speed—that makes every blow count.

The secret of their effectiveness lies in the correct apportionment of the weight and velocity of the ram. With a low velocity blow from a heavy mass of ram, most of the energy is actually used to drive the pile. The energy of a light hammer falling at high velocity is mostly absorbed in the pile itself before inertia is overcome and the pile moves downward. The result—damaged pile heads and little penetration.

Warrington Vulcan Pile Hammers are designed on the low velocity—heavy ram principle. Maximum penetration per blow—fewer blows per pile—the Warrington-Vulcan is the hammer with the real punching action that provides economical pile driving.

VULCAN IRON WORKS

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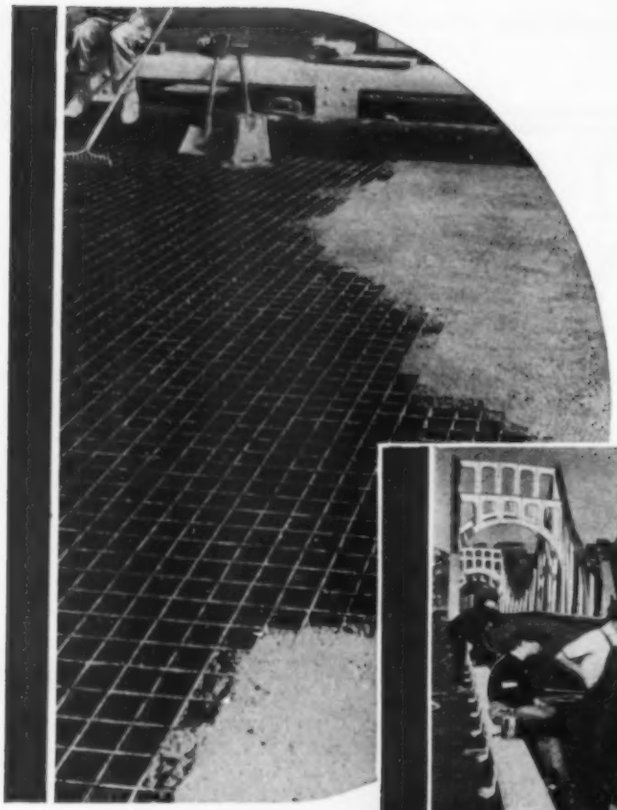
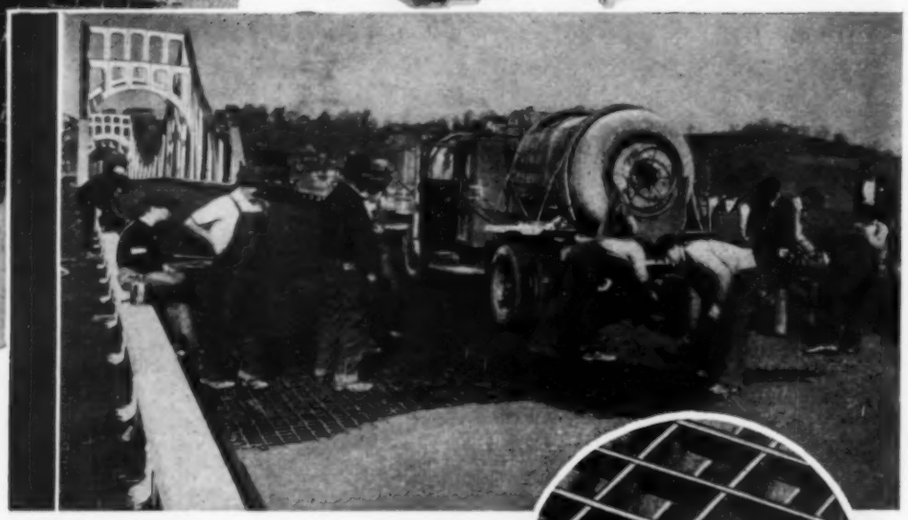
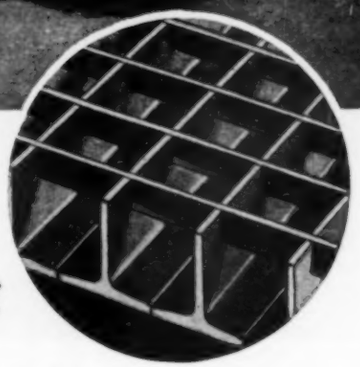
Warrington-Vulcan PILE DRIVERS







One Floor Only *for a* T-TRI-LOK Bridge

WHEN **T-TRI-LOK** is used in bridge construction, it is not necessary to build temporary floors or devise other complicated means of delivering concrete to the job. As soon as the panels of **T-TRI-LOK** have been secured to the bridge stringers, trucks, concrete mixers and other equipment can be driven right onto the floor of the bridge. This immediate use of the floor is no small item of economy and convenience.

T-TRI-LOK provides an armored concrete, non-skid wearing surface of long life and high efficiency. No forms for concrete are required. Send for the booklet **"T-TRI-LOK** Bridge Floor Construction." Carnegie engineers are also at your service.

CARNEGIE STEEL COMPANY • PITTSBURGH

Subsidiary of United States Steel Corporation 182

Construction Methods

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ROBERT K. TOMLIN, *Editor*

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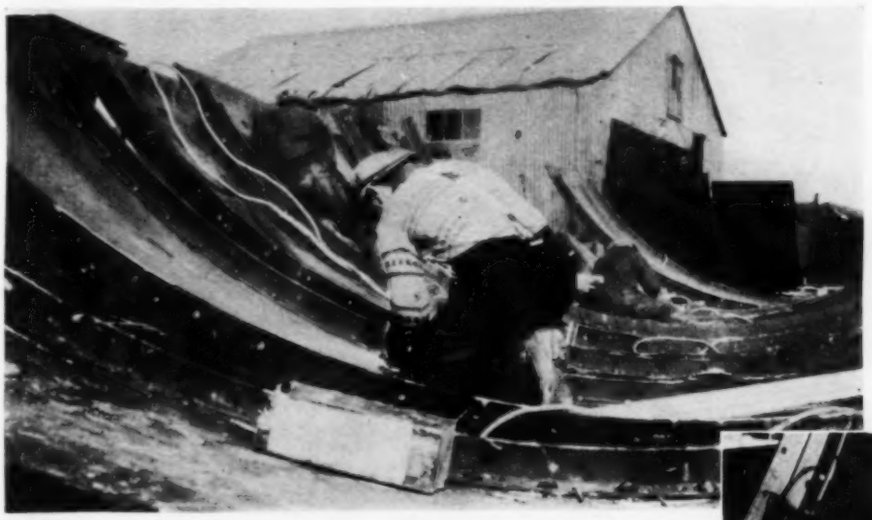
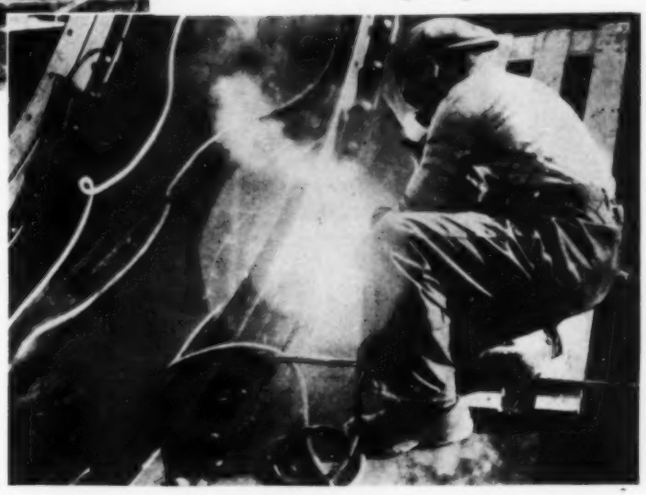


WELDING *(left and below)* makes tight joint between curved steel plates and riveted angles forming flanges.



Tunnel Liner Plates

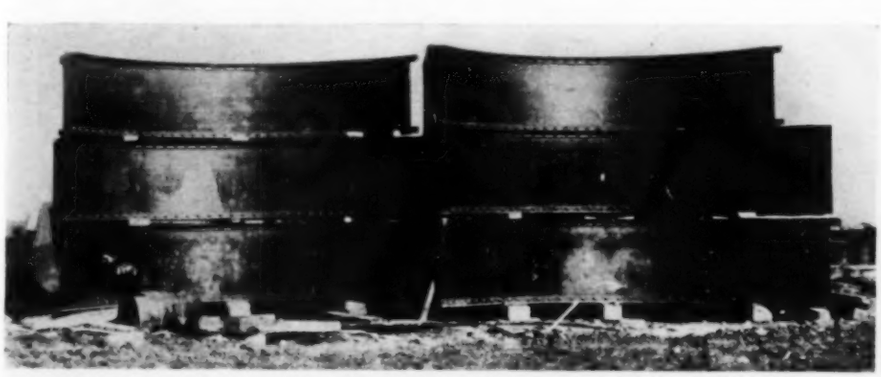
CALKED BY WELDING

AS a substitute for other methods of calking, electric welding was employed by Patrick McGovern, Inc., contractor, to insure watertight joints in steel liner plates used to reinforce a portion of the 20-mile-long City Tunnel No. 2 where it crosses underneath the East River, New York City. The tunnel, let at a contract price of $42,700,000, is part of the Board of Water Supply's system for delivering Catskill water to the Boroughs of the Bronx, Queens and Brooklyn. The bore is concrete-lined and, for the most part, has a finished inside diameter of 17 ft.

The liner construction involved the use of curved steel plates 1 in. thick, 20 ft. long and 4 ft. wide; three plates, assembled, formed a 20-ft. ring. To the sides of each curved plate 4x4x4½-in. angles were riveted to form flanges, and a $\frac{3}{16}$-in. fillet weld bead was deposited against each angle to insure a tight connection. A total of 13,920 lin.ft. of this type of welding was done to prepare the liner plates for assembly in the tunnel.

After the plates were riveted to form a circular steel shell in the tunnel, a calking weld was made along the line of the abutting flange angles. The equipment comprised two 200-amp. and two 300-amp. Lincoln stable-arc welders. For assembling all of the rings 11,832 ft. of welding, including that at the butt joints of the plates, was done in 8 days by four shifts of operators working four to a shift. Using coated rods with the shielded-arc method, the operators averaged 31 lin.ft. of welding per man per hour.

For the New York Board of Water Supply Thaddeus Merriman is chief engineer.



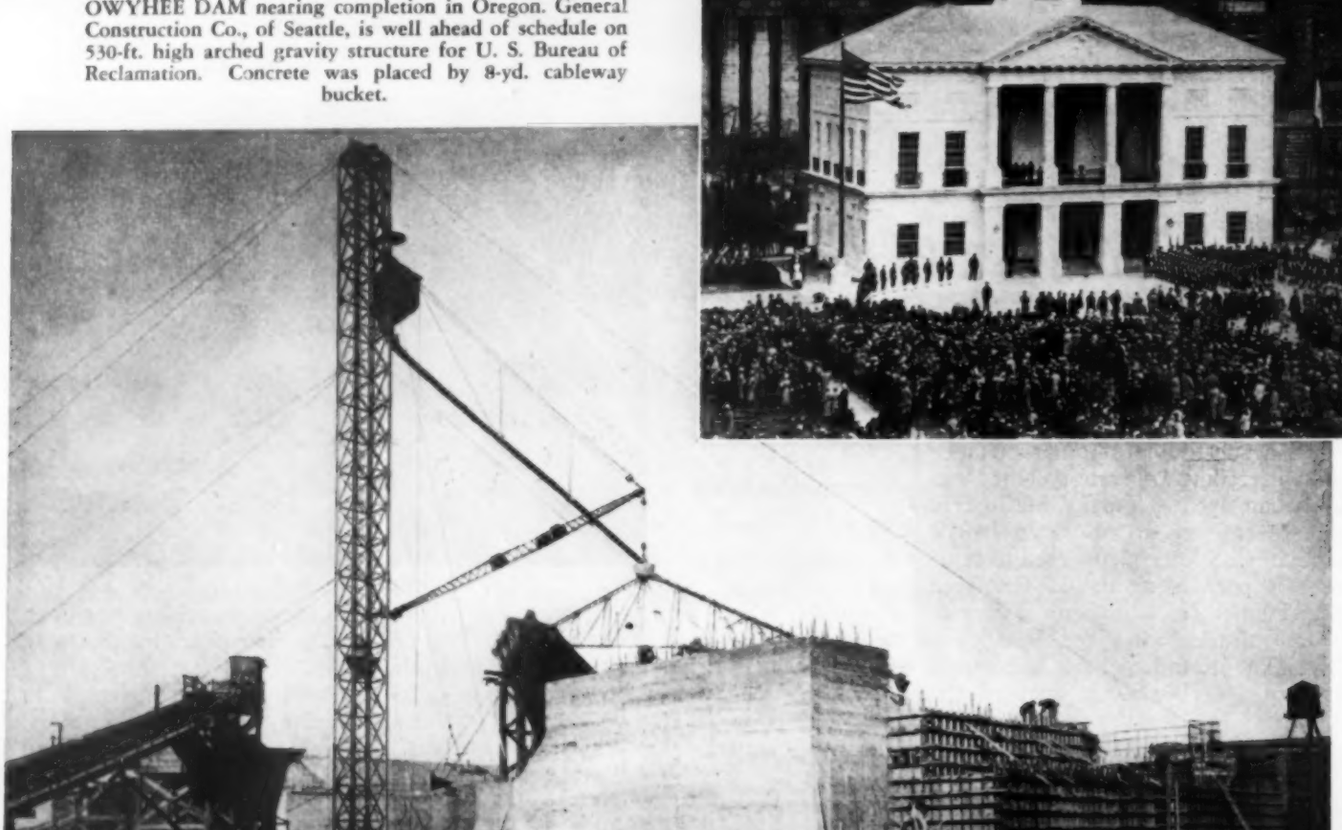
CURVED STEEL LINER PLATES are each 1 in. thick, 20 ft. long and 4 ft. wide.

This Month's "News Reel"

OWYHEE DAM nearing completion in Oregon. General Construction Co., of Seattle, is well ahead of schedule on 530-ft. high arched gravity structure for U. S. Bureau of Reclamation. Concrete was placed by 8-yd. cableway bucket.

REPLICA OF FEDERAL HALL *(below)* in Bryant Park, New York City, is completed in 31 working days by Sears, Roebuck & Co., for re-enactment of presidential inaugural during George Washington Bicentennial celebration. See descriptive article on p. 28.

Acme photo



Keystone photo

ANCHORAGES and pier foundations under construction for Tri-Borough bridge which will link the boroughs of Queens, Manhattan, and the Bronx, New York City, with a structure 17,710 ft. in length, crossing four navigable streams, including the East River. View illustrates progress of work on Arthur McMullen contract in Astoria before operations on the project were halted recently by lack of city funds.

Galloway photo

SYDNEY HARBOR BRIDGE now in service in Australia. Steel arch, with span of 1,650 ft., was erected by cantilevering from each end with aid of special travelers riding on top chords of arch ribs spaced 98½ ft. apart. Dorman, Long & Co., of Middlesborough, England, executed the $18,300,000 contract for the steelwork of the arch and the approach spans.

Acme photo

READY FOR OLYMPIC CHAMPIONSHIPS. Concrete stadium has been completed in Los Angeles to accommodate 80,000 spectators during international athletic contests.

BIG HOLE *(right)* in midtown New York. Portion of three city blocks excavated for Rockefeller Center group building project known as Radio City.

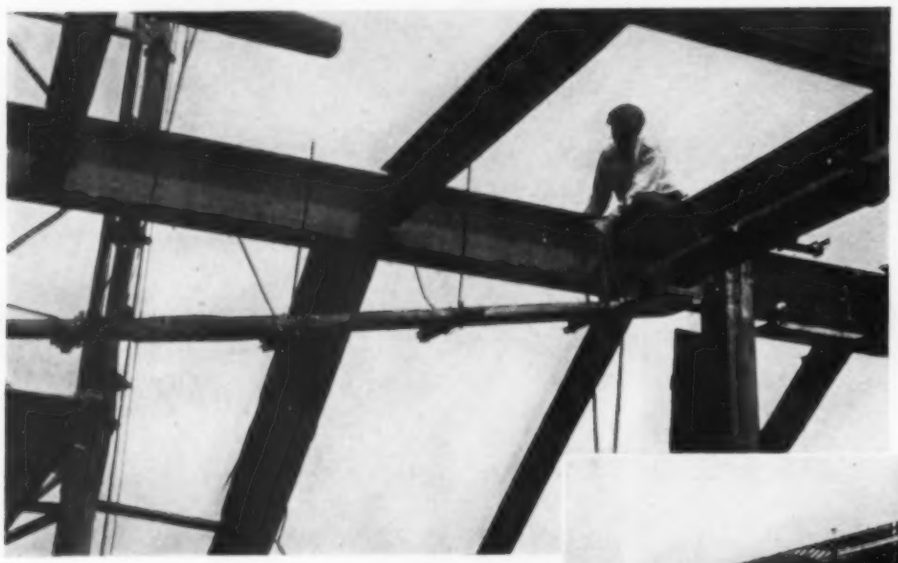
Wide World photo

CLE ELUM DAM *(left)* is one of the latest U. S. Reclamation Bureau's projects at Ronald, Wash. Winston Bros. Co., contractor, of Minneapolis, is handling earth with Bucyrus-Erie shovels. Dam will be earth and gravel embankment 130 ft. high.

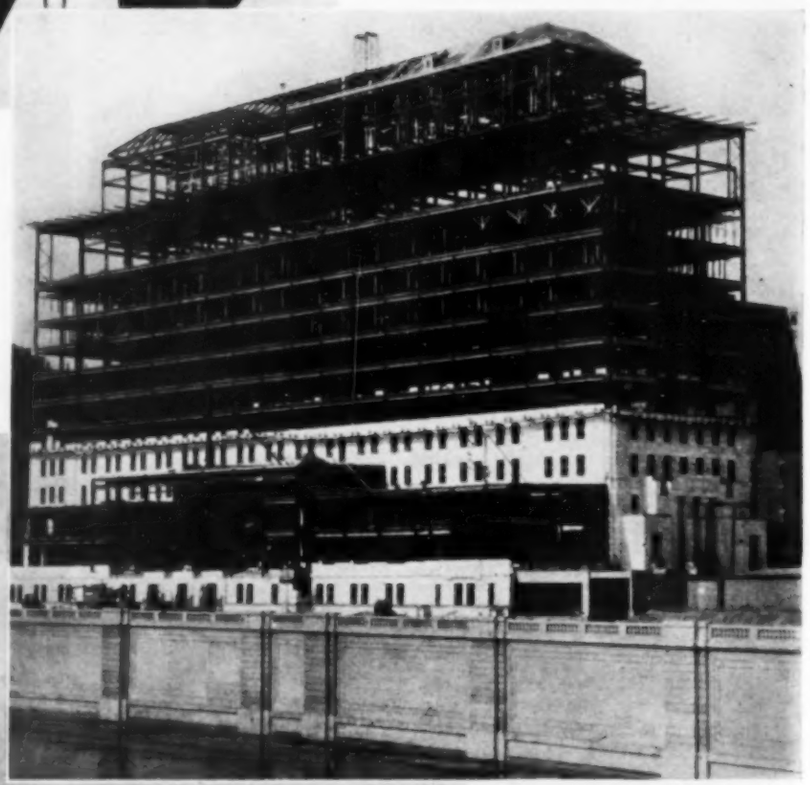
CAREFUL MANAGEMENT *of Building Job* PRODUCES EXCELLENT RECORD

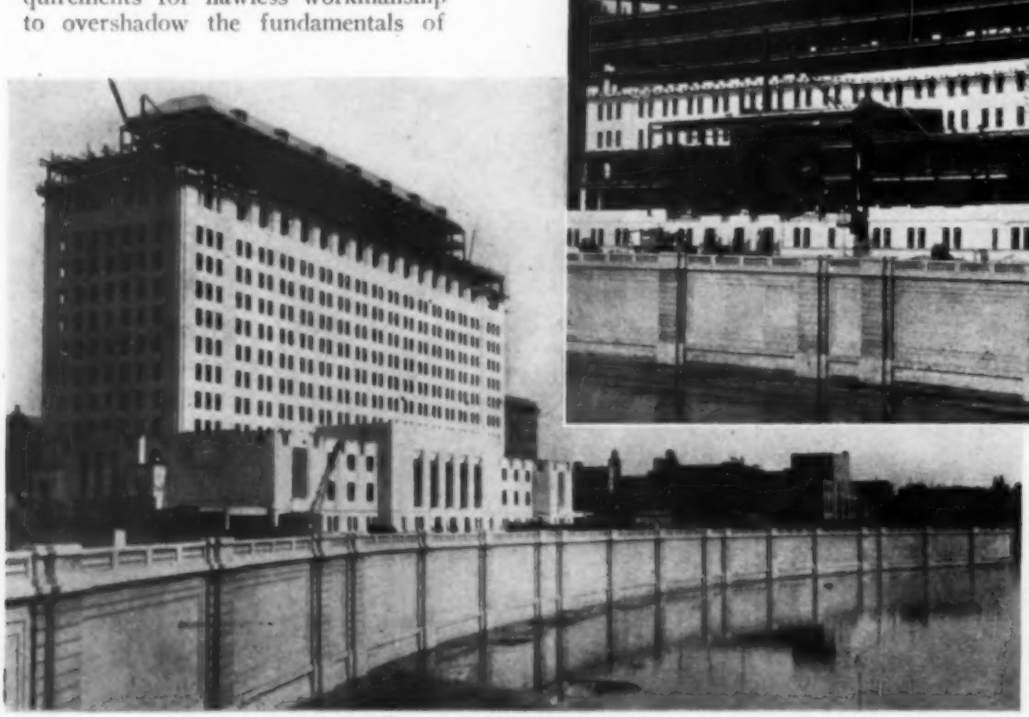
UP TO April 14, when a severe explosion of undetermined origin, beyond the control of the contractor, partially wrecked the almost completed building and caused the death of ten men, the Ohio state office building in Columbus represented a construction project on which capable organization and a well-directed safety program had produced an outstanding record of job efficiency and accident prevention. In undertaking the contract for the monumental structure, the Struck Construction Co., of Louisville, Ky., and Cincinnati, Ohio, did not permit the exacting requirements for flawless workmanship to overshadow the fundamentals of plant layout and safety for the men.

From the start of the job until Feb. 1, when the more hazardous portion of the work had been completed, a safety engineer was employed by the general contractor to keep a vigilant eye on construction activities and to enforce the regulations of the Ohio safety code. Retention of a safety engineer on the work proved effective in reducing the accident frequency and severity rates. By informal talks at opportune times, by personal contacts, and by the posting of stimulating job bulletins, the engineer succeeded in

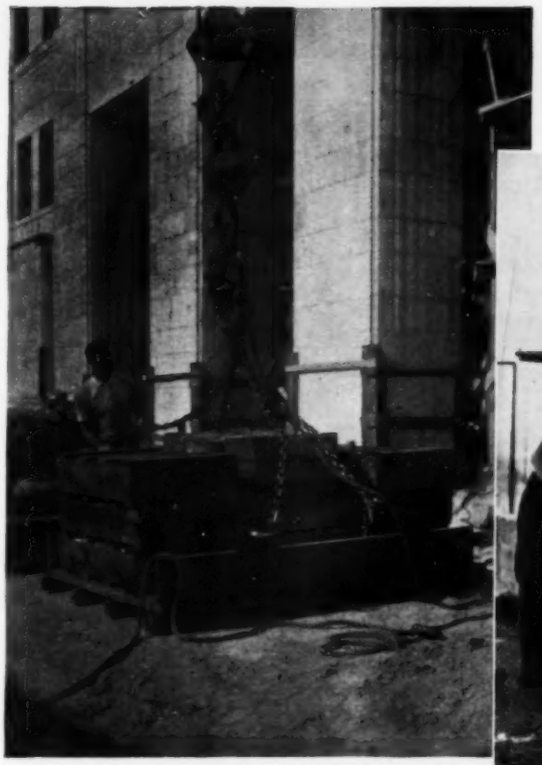


BEAM BOTTOM FORM *(left)* is raised by workmen and suspended from steel beam by strap hangers.



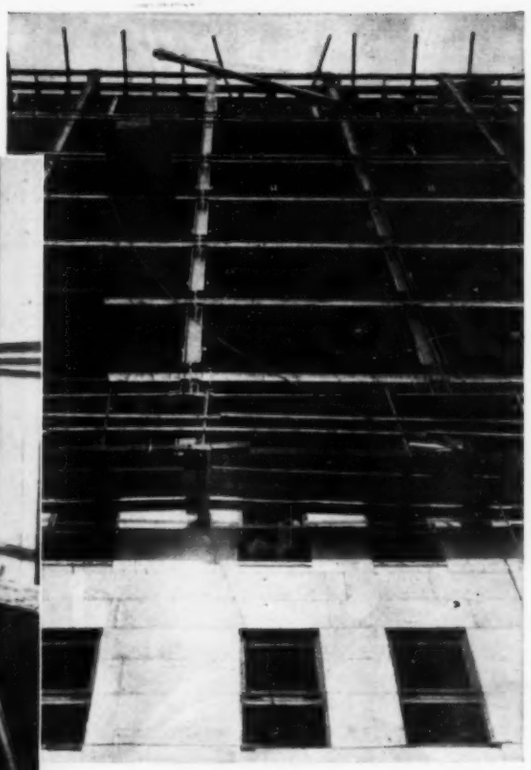


STATE OFFICE BUILDING is steel-frame structure fourteen stories high, with three-story extension on side facing river. Ground floor opens on future boulevard skirting river. Main entrance is on first floor, on level with street at opposite side of building. MARBLE FACING *(left)* provides chaste exterior for monumental structure.



CRATED MARBLE is hoisted in skips by Chicago boom.

HOLLOW TILE *(below)* is used to fireproof exterior columns and to back up marble facing.



CHICAGO BOOM hoists skip-load of marble to cantilevered platform.

keeping safety before the workers' minds. Equally important was his careful and unremitting inspection of the job — detecting and removing hazards, enforcing safety requirements, and culling out careless workmen.

Description of Building—The new state office building is a steel-frame structure, faced with Georgia marble, erected on a large site between Front St. and the Scioto River. Dimensions of the building, to the third floor level, are 317 ft. 6 in. by 118 ft. 6 in. At the third floor level the Scioto River facade sets back 45 ft. 6 in. to the building proper, which is 317 ft. 6 in. by 73 ft. in area. The main structure contains fourteen floors and rises to a height 201 ft. 3 in. above the ground.

The land slopes from Front St. to a concrete retaining wall along the river. Front St. is approximately on a level with the first floor; the entrance on the ground floor opens upon a future boulevard skirting the river.

Floors of the building are of reinforced-concrete joist construction. Beams and interior columns are fireproofed with concrete. Hollow clay tile is used to back up the marble facing and to fireproof the exterior columns.

Foundation and Steel Frame—Spencer, White & Prentis, Inc., of Detroit, operating under subcontract, excavated for the foundations and placed 4,000 yd. of concrete in spread footings. The McClintic-Marshall Corp. furnished about 3,700 tons of structural steel for the frame, which was erected by the Detroit Steel Erection Co.

Material Handling—In laying out the job plant, an economical means of receiving, handling and distributing materials was foremost among the

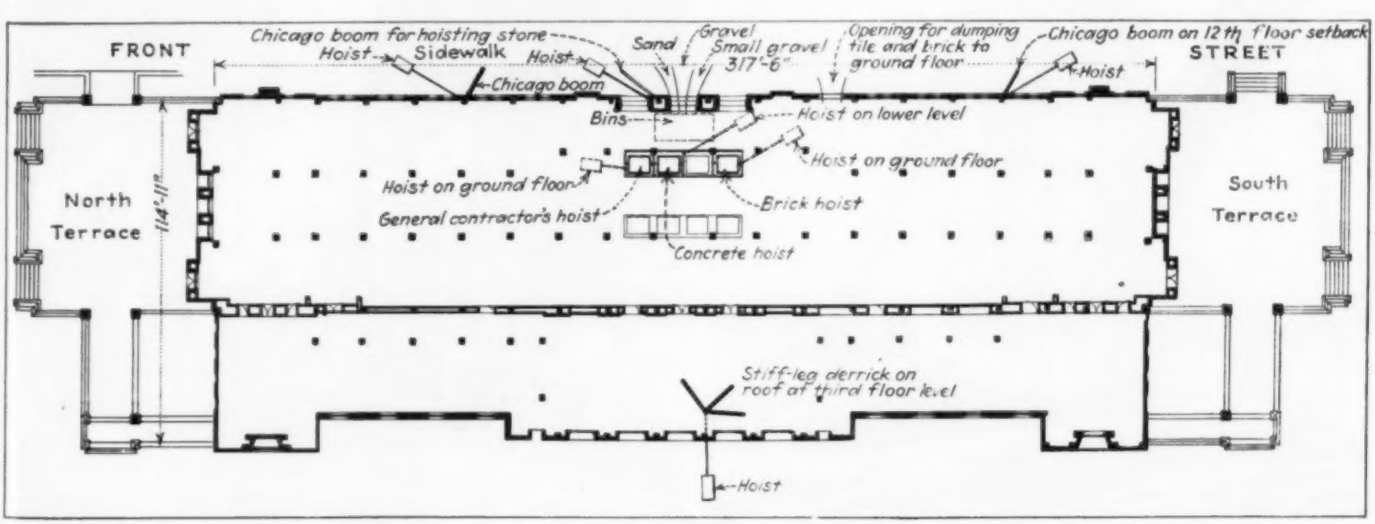


DIAGRAM OF PLANT LAYOUT. Concrete tower and two material hoists are placed in interior elevator shafts. Concrete aggregates, brick, and tile are unloaded on Front St. side into chutes which deliver to lower floors inside building. Mixing plant operates by gravity from bins to bucket in hoisting tower.

considerations of the general contractor. Although practically unlimited space was available around the building, the elevation of Front St., 48 ft. above the basement floor, and the location of permanent elevator shafts on the Front St. side near the center of the building made an interior plant the logical choice. Trucks could deliver to the Front St. side of the building and dump their loads to the ground floor or basement, and material could be distributed on the upper floors from central hoistways with a minimum of labor.

Hollow tile and brick were unloaded from trucks outside the building into chutes which delivered to the ground floor, where workmen loaded the materials in wheelbarrows. Truckloads of coarse gravel, pea gravel and sand also were dumped outside the building into chutes which fed the aggregate bins of the concrete plant.

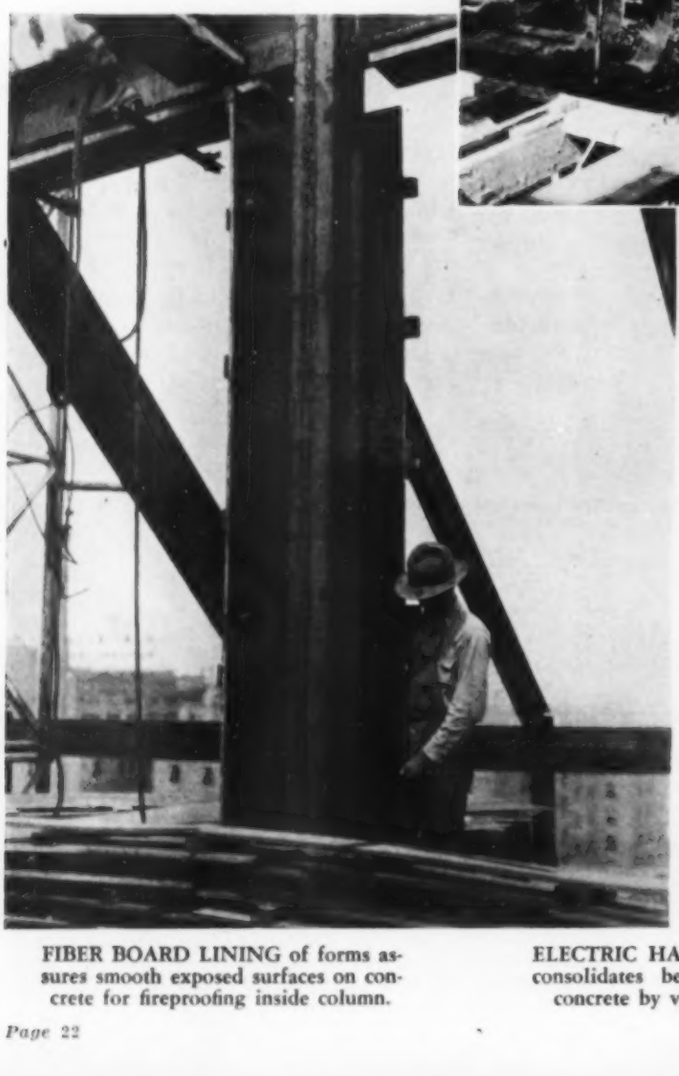
A Lakewood tubular steel tower resting on the basement floor was installed in a permanent elevator shaft close to the concrete plant. Batches were discharged by the Smith 1-yd. tilting mixer through a chute into a 1-yd. tip-over bucket in the tower. The bucket delivered the concrete to a 46-cu.ft. hopper on the floor being poured. In addition to the concrete tower, the Struck Construction Co. installed two material hoists in permanent elevator shafts, as indicated on the diagram of the plant layout.

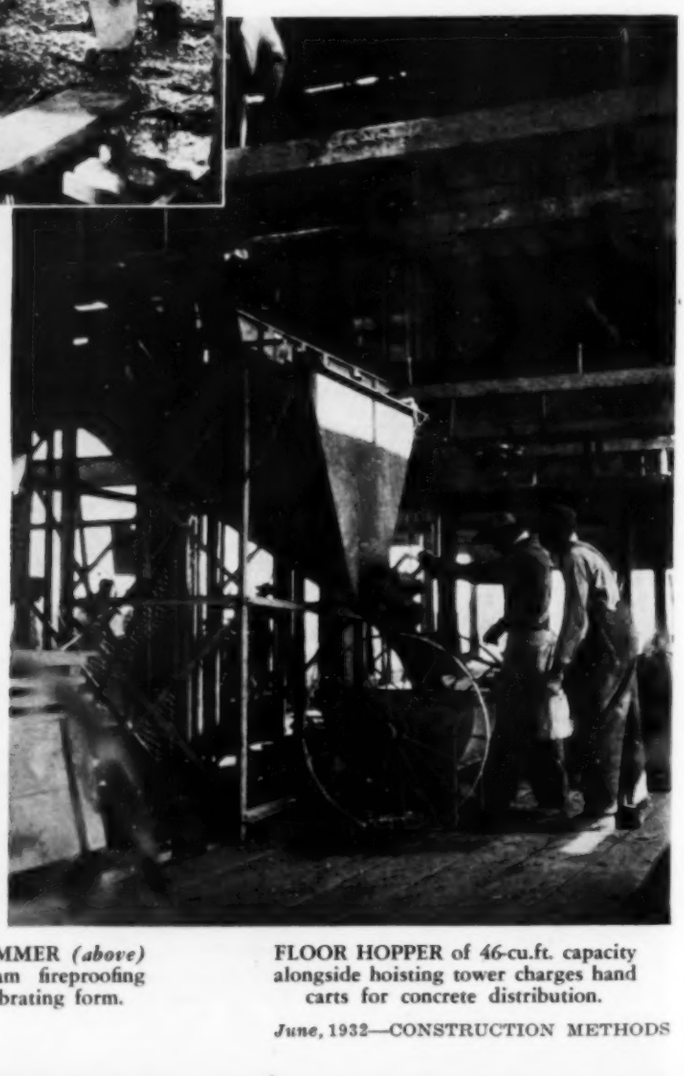
Three Chicago booms hoisted materials on the Front St. face of the building, two at the twelfth floor level being operated by the Struck Construction Co. and one by the stone-setting subcontractor. A wood stiff-leg derrick was erected by the stone contractor on the roof of the three story extension facing the river.

Floors and Fireproofing — Domes and shores for the tapered joist floors were supplied and erected by the Hausman Steel Co., of Toledo. The Struck Construction Co. made and erected all forms for beams and columns. Three LeRoi gasoline saw rigs and two Wodack electric hand saws proved useful in cutting form lumber. Forms for all exposed surfaces were lined with Masonite Presdwood.

Lakewood 6-cu.ft. hand carts were used to distribute concrete from the floor hopper to the area being poured. Each of the floors from the third to the twelfth, having an area of approximately 23,000 sq.ft., was concreted in three equal pours. Black & Decker electric hammers vibrated the concrete inside the beam forms. Two Jaeger 10-cu.ft. concrete mixers were used for small pours around the job.

Setting Stone — The Winfrey-Wilson Co., Shreveport, La., set 90,000 cu.ft. of marble facing, supplied by the Georgia Marble Co., Marietta, Ga. After the stone had been hoisted on skips by the Chicago boom and stored on a floor in advance of erection, it was set by means of small

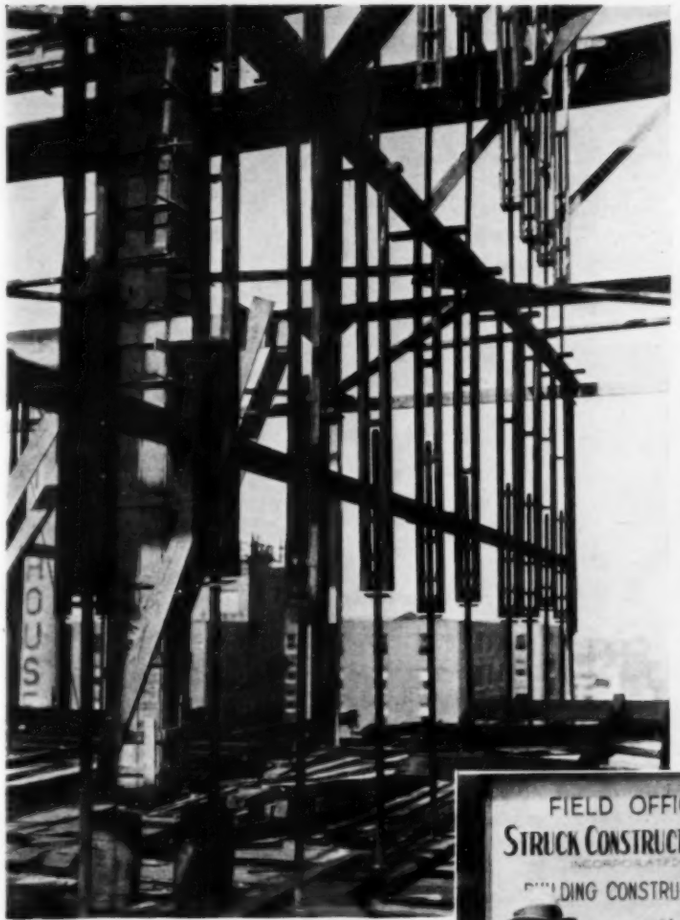




FIBER BOARD LINING of forms assures smooth exposed surfaces on concrete for fireproofing inside column.

ELECTRIC HAMMER *(above)* consolidates beam fireproofing concrete by vibrating form.

FLOOR HOPPER of 46-cu.ft. capacity alongside hoisting tower charges hand carts for concrete distribution.



DOUBLE TIER OF ADJUSTABLE SHORES supports floor forms in high room on thirteenth floor.

INSTALLING STEEL FORMS for reinforced-concrete tapered-joist floor.

CHARLES E. MARTIN, JR. *(left)*, superintendent for Harry Hake, architect; T. C. NEB, superintendent for Struck Construction Co. until his death, April 16, 1932, from effects of explosion; and E. P. MARTIN, contractor's safety engineer.

hand-hoist units operated on the floors above. An accompanying photograph shows one of the hoisting units, about ten of which were in use. The unit consisted of a Beebe hand hoist mounted on a wood horse equipped with an idler sheave at the fore end. The load line from the hand hoist ran on this sheave. Signals were given by bell rope from the floor below on which stone was being set.

Subcontractors—The Struck Construction Co. was general contractor for all work except the plumbing, heating, ventilating, refrigeration, elevator and electrical installations. Separate contracts for these mechanical trades were let by the Building Commission. In addition to those previously mentioned in this article, the Struck Construction Co. had the following important subcontractors working with it: J. R. Payne Co., of Birmingham, Ala., laying 750,000 4x5x9-in. hollow tile and 25,000 common brick; C. D. Stewart Co., of New Albany, Ind., placing 800 tons of reinforcing steel; Truscon Steel Co., of Youngstown, Ohio, erecting steel sash and steel deck for pipe space on the thirteenth floor; Forshee Co., of Columbus, installing sheet metal, roofing, flashing and counter-flashing; Alabama Marble Co., furnishing and placing all interior marble; Hughes-Keenan Co., of Mansfield, Ohio, erecting metal stairs; United Metal Products Co., of Kent, Ohio, installing hollow metal work and elevator enclosures; and U. S. Gypsum Co., erecting partitions.

Safety work—E. P. Martin was retained on a part-time basis to direct safety work on the job. Mr. Martin spent half of each working day on the job, inspecting and correcting construction practices and building up and maintaining the mental alertness necessary in safe workers. Through long experience in his field, the safety director was able to detect and remove hazards which would have escaped the attention of most construction men, whose minds are usually more intent on other matters.

At every lull in operations, caused by bad weather or other unfavorable condition, Mr. Martin talked to the workmen, making his remarks directly applicable to their work. The whole scheme of arousing and maintaining safety consciousness was based on the psychology of direct, localized appeal to the workmen.

An example of this local touch was the job bulletin, copies of which were posted in conspicuous places where workmen could not miss seeing them. The bulletin gave the job safety record to date and exhorted the workers to be careful in certain specific matters. Frequent publication of the job record inspired pride and encouraged even greater desire to avoid accidents.

Items in the program of the safety

engineer included, among others, inspection of wire cables and sheaves, provision of goggles and respirators for cement handlers in inclosed spaces, colored goggles for men using cutting torches, elimination of riding on load lines, wood guards around wire rope cables close to workmen, wood treads on steel-pan stairs, temporary handrails on stairs and guard-rails on exterior unloading platforms and around floor openings, wire netting and safety gates on hoistways, electric lighting of inclosed stairways and corridors, removal of debris and careful housekeeping, temporary doors on passenger elevators used by workmen, guard rails and toe boards on hanging scaffolds, and liberal use of large painted danger signs and placards. Of particular interest was the signal system on the general contractor's material hoist. To prevent a signal's being given to the hoist operator from any floor but the one on which the cage was stopped, the signalling device was placed on the cage itself.

Accident Record—Results of the job safety program may be seen in the accident record. With a total of 807,400 man-hours worked on the job to Feb. 1, 1932, only 25 lost-time accidents had occurred, entailing a total time loss of 9,520 hours. The worst accident was a sprained back sustained by a carpenter who attempted to lift two adjustable shores instead of one.

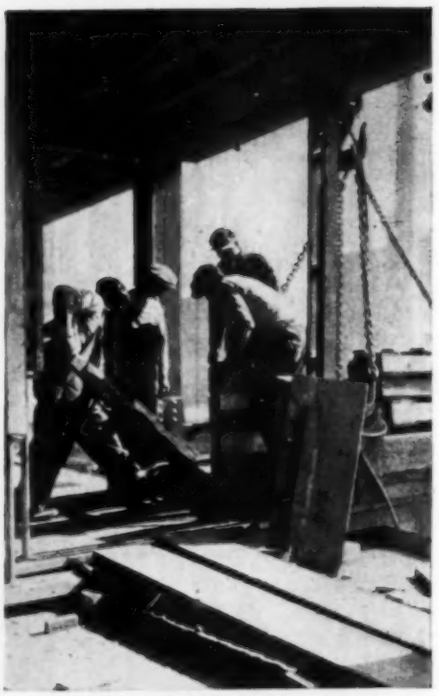
Of the 25 lost-time accidents, only sixteen were compensative, that is, accidents causing loss of time of 7 days or more. The causes of these accidents were as follows:

Sprained backs	3
Struck by falling objects	2
Striking against objects	4
Foreign bodies in eyes	1
Falls from staging	1
Sheaves and cable	1
Hernia	1
Nail puncture	1
Struck by brick hoist	1
Total	16

The severity rate (the number of days lost per 1,000 man-hours worked) from the start of the job to Feb. 1, 1932, amounted to 1.47. As the average severity rate for building construction is around 6.0, it may be seen that safety work on this job produced striking results. The average severity rate for 1930 of the general building contractors reporting to the National Safety Council (which includes those most active in carrying on safety work) was 4.84.

Administration—In charge of construction of the Ohio state office building for the Struck Construction Co. was T. C. Neb, superintendent, who died as the result of injuries 2 days after the explosion. Charles E. Martin, Jr., superintendent, supervised the work for Harry Hake, of Cincinnati, the architect.

GUARD RAILS and toe boards protect all floor openings. Floors, corridors, and stairs are kept clean.



HAND TRUCKS distribute marble from unloading platform and store it on floor. Stone is not stored dangerously close to edge of floor.

HAND HOIST mounted on wood horse is used in setting marble. Signals are given by bell rope from floor at which stone is being set.

STONE SETTER places marble block suspended on load line from hand hoist on floor above.

Driven Casing Extracts LONG EARTH CORES

New Method of Exploration Indicates Subsurface Conditions for Depths of 30 to 40 Ft.

LONG earth cores, showing accurate vertical sections of subsoil conditions down to depths of 30 to 40 ft., may be obtained by methods and special equipment developed at the West Side sewage treatment plant of the Sanitary District of Chicago by A. J. Forschner and R. H. Burke, of the T. J. Forschner Construction Co. The method, which is patented, consists of driving successively to the desired depth two structural-steel shapes, a 4x4-in. angle and a 7-in. channel, and then withdrawing them simultaneously to inclose a triangular core of earth. When the channel is removed from the angle, after being drawn from the ground, a complete vertical section of the subsoil is in evidence.

The new exploration method was developed to yield information as to subsoil conditions more accurate and reliable than that obtained from test pits. Its first practical application was at the sewage plant in preparation for the construction of a battery of aeration tanks being built under direction of L. B. Barker, principal construction engineer of the District. Tough clay is found at a depth of 20 to 40 ft. over most of the area, but above it there is a complicated subsoil consisting of sand, silt, clay and peat.

An air-driven pile hammer is used to drive the steel shapes into the ground. The angle is driven first. Its length is such that after it has penetrated the tough clay for 1 ft. or so there are still several feet above ground. A 7-in. channel is then driven down alongside it in such a position that the inside of the web spans across the angle's outstanding legs, forming a triangular core space. For the lower 18 in. the channel's flanges are crimped in so as to grip the angles legs loosely, forming an interlock and guiding the channel during driving. Channel and angle are driven to the same depth.

For pulling the casing after driving, a heavy latch bar is inserted in a slot near the top, extending through both angle and channel. This bar is lashed to a six-sheave block reeved to a similar block at the top of the leads and thence to the drum of the crane. In this way a pulling power of 75 tons is obtained, with the thrust transferred to the ground through the leads, which have a spread base for bearing. After the casing members have been withdrawn, a lever jack is used to slide the channel along the angle until the crimped section is clear, when it can be lifted off. A complete triangular core of the subsoil to the depth penetrated is then available, showing plainly the thickness and depth of the various strata. Information is available as to the moisture content at various depths, and the engineer is enabled to judge the relative hardness and bearing value of the material encountered.

At points where the hard clay is thought to be more than 30 ft. below ground, 40-ft. lengths of steel are used. Otherwise, 30-ft. sections are sufficiently long.

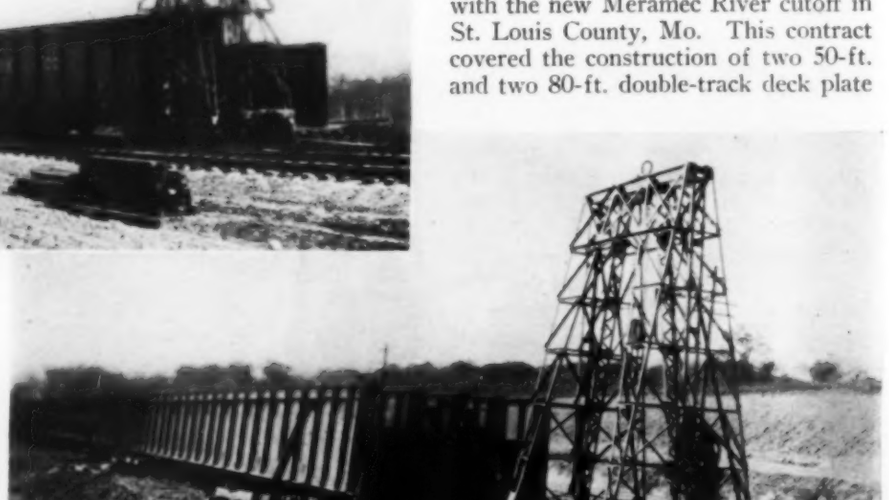
PILE HAMMER drives separately to desired depth two structural steel shapes, a 4x4-in. angle and a 7-in. channel. CORE *(insert above)* reveals character and thickness of subsurface strata.

Step-by-Step

Erecting Long Plate Girder

AMONG recent activities of the Kansas City Bridge Co., of Kansas City, Mo., was the erection of 88 girders for the Missouri Pacific Railroad Co., in connection with the new Meramec River cutoff in St. Louis County, Mo. This contract covered the construction of two 50-ft. and two 80-ft. double-track deck plate

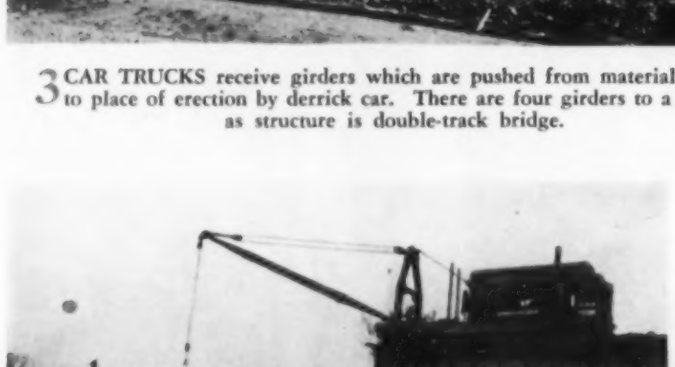
1 UNLOADING 120-ft. plate girders, weighing 65 tons each, from cars, using derrick car and steel gantry. Center-to-center distance between wheels on gantry is 13 ft., which allows cars to be pulled out from under girders.



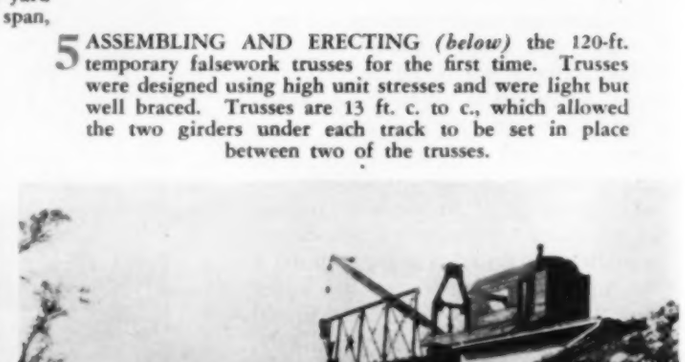
2 GIRDERS transferred to skids in material yard, with gantry standing by. Gantry is operated by hand winch, using ¼-in. steel cable working through two five-sheave blocks.

3 CAR TRUCKS receive girders which are pushed from material yard to place of erection by derrick car. There are four girders to a span, as structure is double-track bridge.

5 ASSEMBLING AND ERECTING *(below)* the 120-ft. temporary falsework trusses for the first time. Trusses were designed using high unit stresses and were light but well braced. Trusses are 13 ft. c. to c., which allowed the two girders under each track to be set in place between two of the trusses.



4 DERRICK CAR places one of temporary falsework trusses. Three of these trusses are used, and after a span is erected, each truss is moved ahead as a unit.



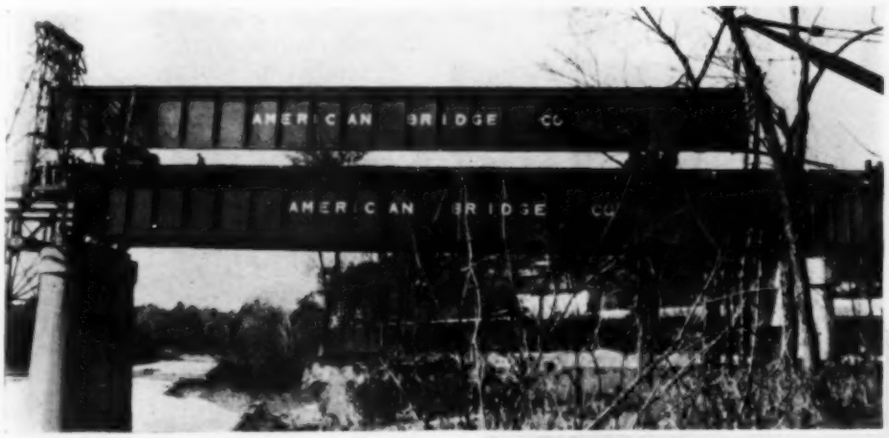
Field Methods

Spans for Railroad Bridge

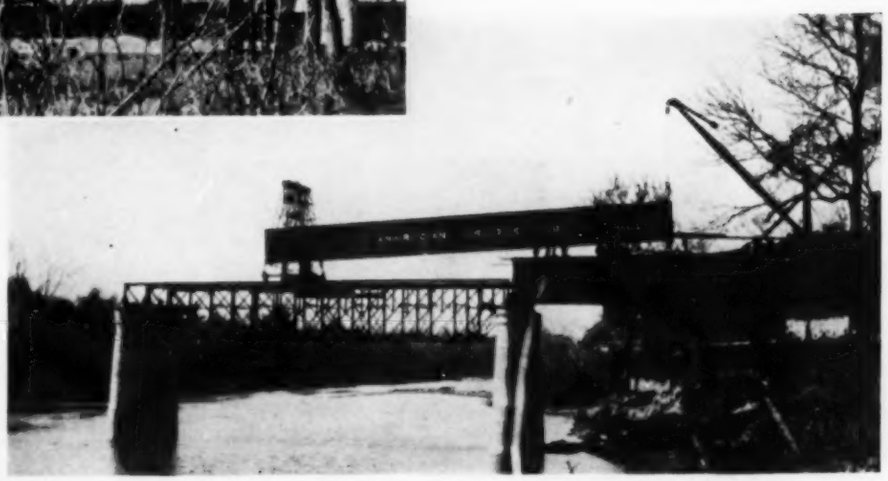
girder spans with concrete decks, eight 80-ft. and ten 120-ft. double-track deck plate girder spans with timber decks.

The 50- and 80-ft. girders were placed in the usual way with a derrick car. The 120-ft. girders were erected with a derrick car and a traveling gantry, as illustrated in the accompanying series of photographs. A span of four girders, each weighing more than 65 tons, was completed every four days. Light steel falsework trusses with track on the top chords were erected to accommodate the traveling gantry.

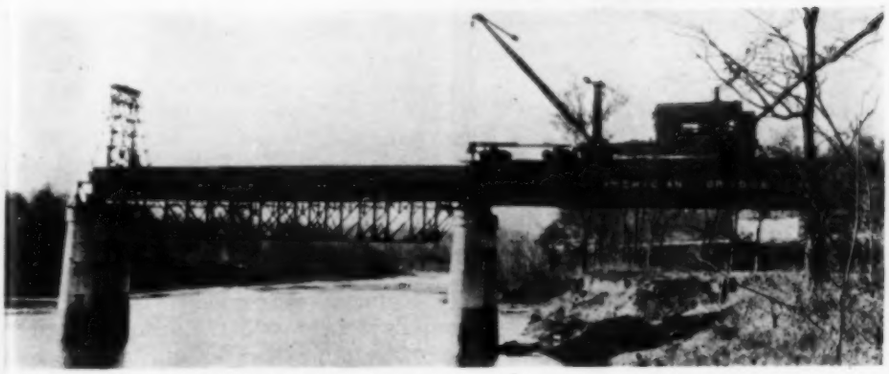
6 PLACING GANTRY IN POSITION to enable it to run on rails placed directly on top chords at trusses.



7 GIRDERS *(above)*, after having been brought out on car trucks, are lifted clear of trucks by derrick car at one end and gantry at other end.



8 ROLLED FORWARD *(right)*. Girder, supported by gantry and derrick car, is pushed by derrick car.



9 LOWERED *(left)* on to its shoes. After the two girders under one track are placed gantry moves over and with derrick car operating on other track, the other two girders are placed. Trusses then are moved ahead and operation repeated.

OLD PRINT of Federal Hall guided architectural design of replica.

Replica of Federal Hall Built in 31 Days

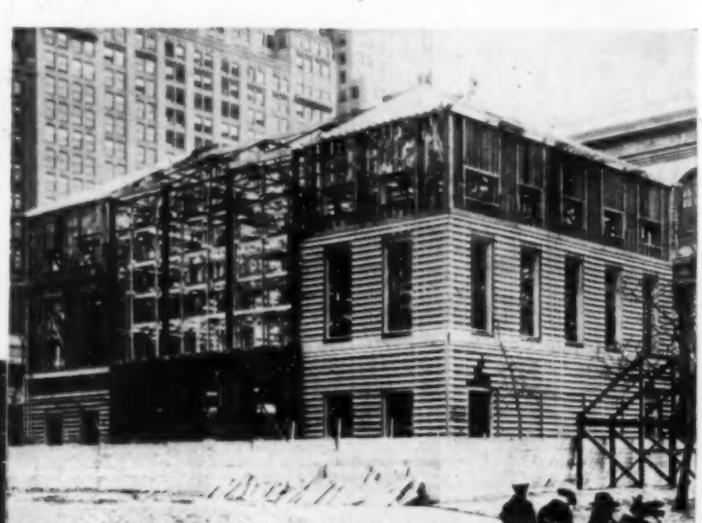
Historic Structure Reproduced by Sears, Roebuck & Co. for Washington Bicentennial

REQUIRING only 31 working days for its completion and involving special details of timber framing and plaster ornamentation, Federal Hall, where the first President of the United States took the oath of office in 1789, was reproduced in replica in Bryant Park, New York City, as a setting for the inaugural ceremony reenacted April 30 as part of the city's program for celebrating the George Washington Bicentennial. The structure, 59x95 ft. in plan and 100 ft. from ground level to top of cupola, was built by the home construction division of Sears, Roebuck & Co. from designs prepared by Joseph G. Friedlander, architect, after extensive historical research and study of old prints in order that the building, in architectural appearance, although not in structural detail, should be a precise facsimile of the original.

For the speedy construction required to finish the building in time for the inaugural ceremony the design called for a timber frame sheathed both inside and outside with ⅜-in. fibre-incased gypsum sheets nailed to the studding and finished on the outside with a false stone composition. To avoid the necessity of splicing, long timbers of Pacific Coast fir were used for the framing. For studding, 2x12's, 36 ft. long, and for the four corner posts, 12x12's, 48 ft. long, were used. This lumber was cut to measure at the Port Newark (N. J.) plant of Sears, Roebuck & Co. and trucked to the job, ready for erection.

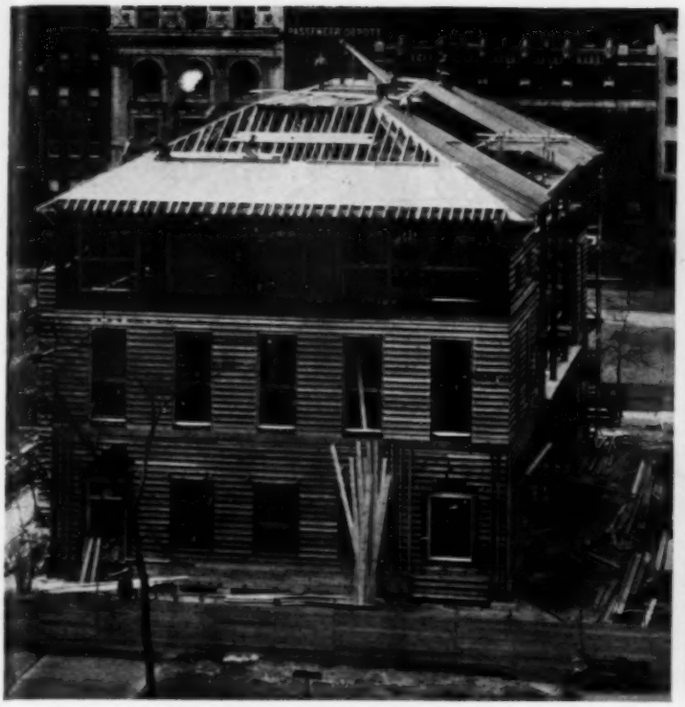
Several of the roof trusses are 60 ft. in length, the proscenium arch necessitating a 40-ft. span capable of carrying one end of the two center roof trusses. When wooden columns for truss supports were detailed it was found that size prohibited their use, as they encroached on the auditorium wall and destroyed the interior contour. Steel columns and trusses, therefore, were used at these points. With this exception, all framing is reproduced with as much exactness as the decorative detail.

The foundation is a series of spread footings, the wooden corner posts, 12x12 in. by 48 ft., being stepped in 18-in. steel shoes set in concrete. Side

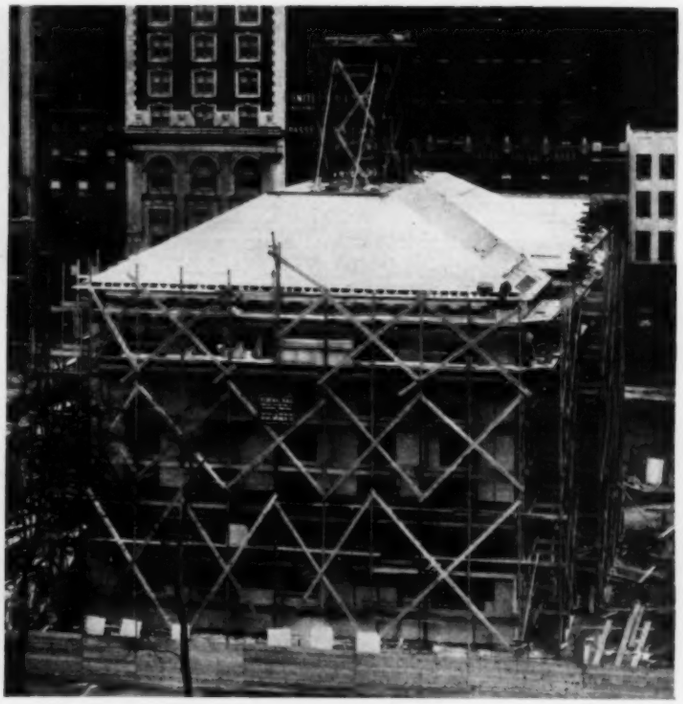


STUDDING *(right)* for side walls is 36 ft. long, extending to auditorium ceiling.

ROOF TRUSSES and columns of steel were used. Remainder of framing was done with Pacific Coast fir.



ROOF is platform section 18 x 54 ft., carried on stringers framed over top chords of transverse trusses.



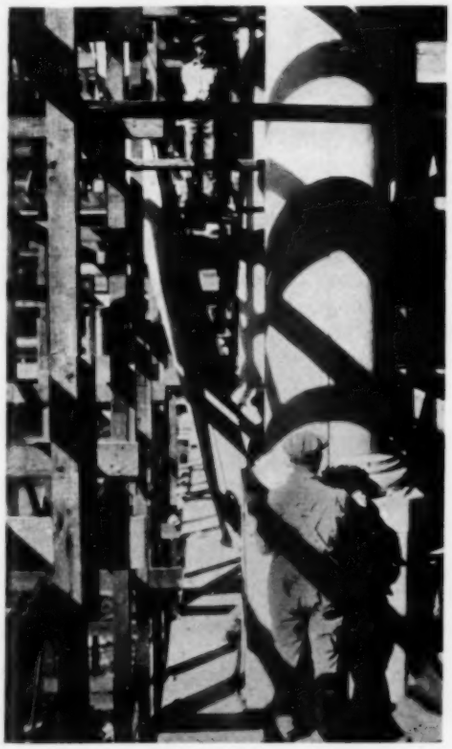
CUPOLA is carried to elevation 12 ft. above eaves. Sheathing is of gypsum wall board covered with false stone.

walls are of 2x12- and 3x12-in. rough fir studs, doubled at all jambs. The lower section of the studding is 36 ft. long and extends to the auditorium ceiling. The upper sections continue for 12 ft. to the eaves having a 4-ft. lap splice. Tops of studs are plated and ribboned with 2x12's.

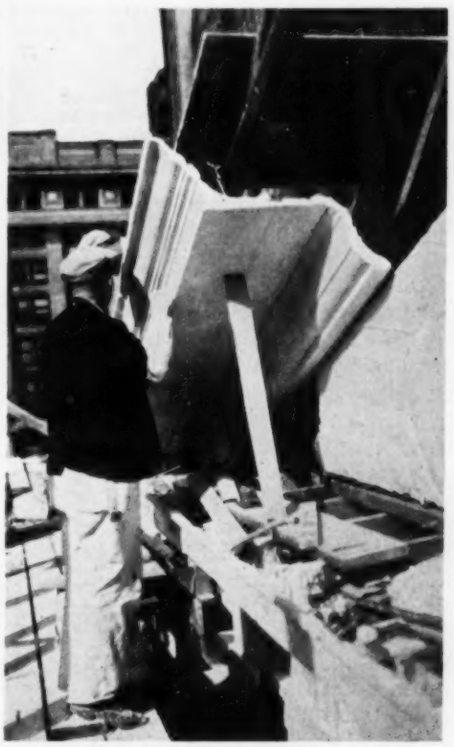
The roof consists of a platform section 18x54 ft., supporting the cupola, 12 ft. above the eaves. This platform section is carried on stringers framed over the top chords of the transverse trusses. The stringers extend to meet the end hips, which are laminated trusses, one portion of the top chord being the upper fourth of the corner posts. Double rafters are placed at all jamb studs and are knee-braced with two 2x10's. This type of roof bracing ensures maximum rigidity and, occurring in the upper third of the wall, is of decided advantage where high winds are prevalent. The roof finish is of composition shingles surfaced to give the appearance of hand-riven slate.

A 16x16-ft. cupola framed of 6x6-in. timbers on the platform portion of the roof extends to a height of 37 ft. and carries a weather vane. The absence of gutters on both roof and cupola is one of the adherences to

WALL BOARDS of gypsum are used to sheath sides of building and serve as base for false stone finish.



COLUMNS are encased in sections of molded material to hide steel.



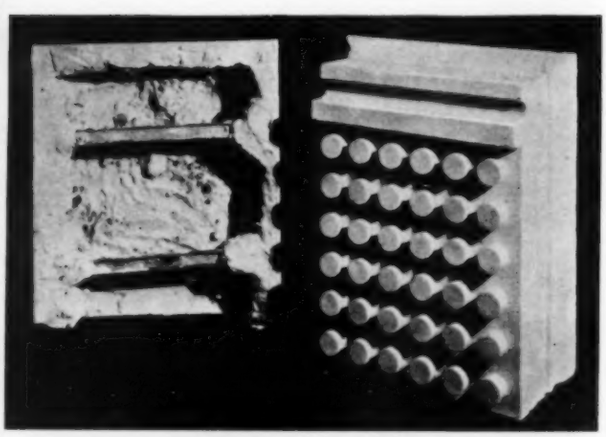
DECORATIVE PANELS, cast in glue composition molds, are wired to framing.

faithful replica of the original. An auditorium 43 ft. 8 in. wide extends the entire length of the structure. Entrance is through a flagged loggia 14x44 ft., on the right of which is a coat room, 14x24 ft., and on the left a stair well of the same size leading to the balcony level.

To support the exterior false stone surfacing 1x6-in. square-edged boards, spaced 10 in. on centers, were fastened to the studding. The entire exterior is finished in plaster on gypsum wall board. The building volume is about 350,000 cu.ft. Lumber was framed and placed at an average rate of 1,000 board feet per working hour.

PEDIMENT 8 x 40 ft. in area, cast in three sections, has maximum depth of 2 ft. at eagle's head.

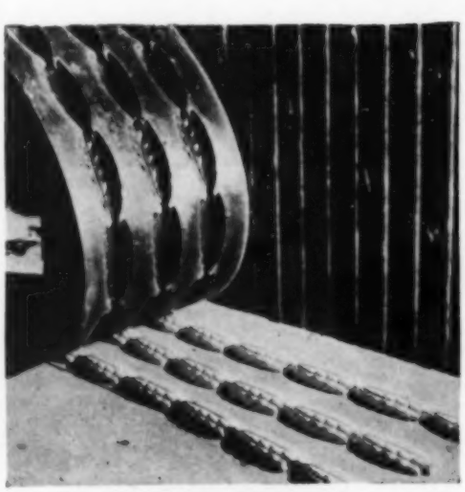
REMOVING CAST from glue composition mold.



METAL STRIPS and burlap reinforce plaster casts.

One of the special features of the building is the method of casting and applying the decorative panels. Models are made in the usual manner and a flexible negative mold of glue composition is then poured, the face of the design being in the bottom of the mold. The false stone composition, reinforced with burlap and metal strips containing wires for fastening to the building, is then poured. After setting, the flexible mold is stripped from the finished cast.

Cornice, trim, pediment and columns were made by this method. The pediment, 8x40 ft., was cast in three sections, the center section containing an eagle and shield 14 ft. long, 8 ft. high and having a maximum depth of 2 ft. Main columns, 18 ft. high and tapering from 3 ft. diameter at the base to 2 ft. 6 in. diameter under the capital, were cast in two halves and fastened to the framed support. After placement, a finish coat of marble dust was blown over all precast portions.



FLEXIBILITY is feature of glue molds, making stripping easy.

The molding and casting of the ornamental false stone-work was done by I. W. Doktorczyk, Belgian sculptor and decorator, who was in charge of similar work on buildings for the French Colonial Exposition in Paris. Including the cornice and pediment, about 20,000 sq.ft. of imitation marble was applied to the exterior of the structure.

For Sears, Roebuck & Co., construction of the Federal Hall replica was in charge of H. W. Ordeman, under the direction of Gustave Meissner, general superintendent of the company's home construction division. The completed structure is illustrated in the pictorial news section of this issue, p. 18.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction

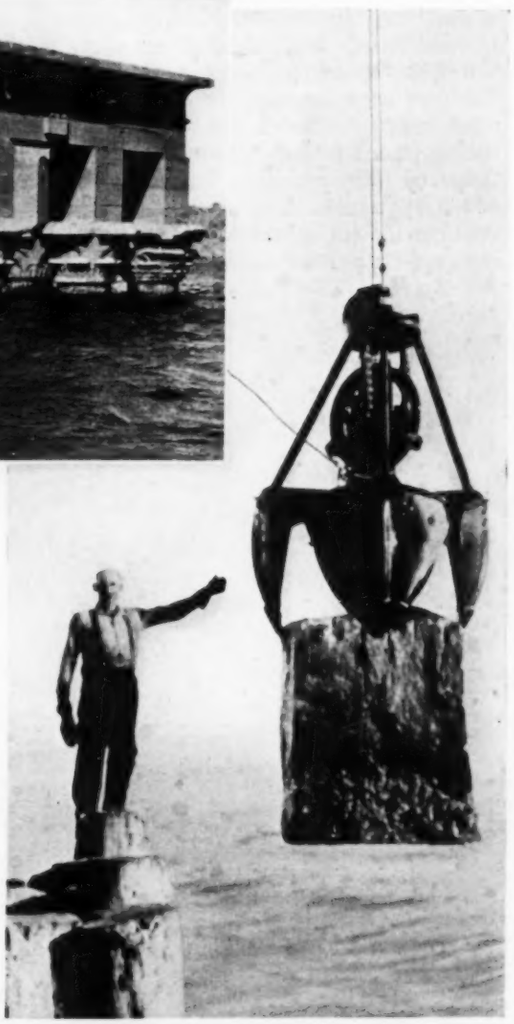
CRANE AIDS RESCUE WORK *(left and above)*. Equipped with clamshell bucket Universal truck-mounted unit excavates shaft at Baxter Springs, Kan., alongside 250-ft. oil well hole into which 3-year-old boy had fallen. Child was suspended in bore 16 ft. below surface. Crane bucket dug 22-ft. shaft from which drift was extended to well hole for recovery of child after having been imprisoned under ground 12 hr. When shaft struck soapstone at depth of 12 ft. bucket had to be dropped with care to prevent cave-in.

Wide World photo

TEMPLE TOWN SUBMERGED. Water rising behind heightened Aswan dam across River Nile, in Egypt, reaches tops of columns of ancient buildings on Island of Philae.

Keystone photo

CRAWLER TREAD principle applied to wheelbarrow. Revolving track carries loads over soft ground.



A 7-TON BITE. In building breakwater at Waukegan, Ill., Luedtke Engineering Co. handles large rock with orange-peel bucket operated by Hercules wire rope.

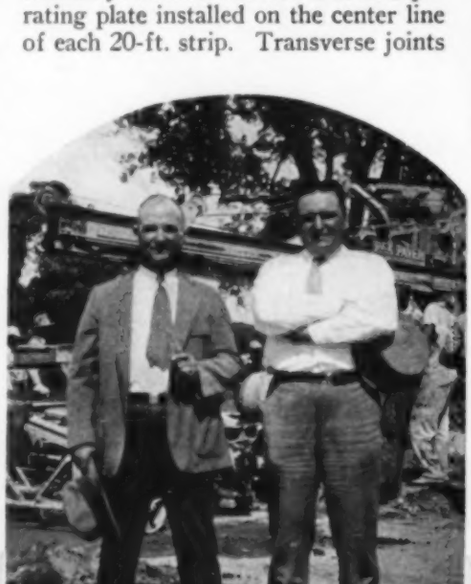
TWO PAVERS IN PARALLEL

Concrete Dunes Relief Highway 40 Ft. Wide

UNUSUAL methods of grading and paving have featured the construction of the Dunes relief highway, a 40-ft. concrete road 29.6 mi. long between Gary, Ind., and the Michigan-Indiana state line. The new highway parallels in general direction the older Dunes highway, a short distance to the north, traffic from which will largely be diverted to the new high-speed through route. To expedite traffic on the Dunes relief highway the road bypasses all towns and crosses no important railways or heavily-traveled intersecting highways at grade. Grade separations were constructed at four railroad crossings and at one main highway crossing.

The 40-ft. width of concrete was constructed in two 20-ft. strips, the second being laid at least ten days after the first. No joint material or oil was used between the two strips, the fresh concrete of the second strip being placed directly against the clean edge of the first. The center of the 40-ft. pavement is 3-in. higher than the outside edges, and each 20-ft. strip has a $\frac{3}{8}$-in. parabolic crown.

Each 20-ft. strip is 8 in. thick, with outside and inside edges thickened to 9 in., this thickness tapering to 8 in. in $2\frac{1}{2}$ ft. In each strip, a single reinforcing bar was placed longitudinally in the outside edge. The only longitudinal joint material was a steel separating plate installed on the center line of each 20-ft. strip. Transverse joints were installed only at the end of each day's run.



Parallel-Paver Operation—Most interesting of the paving operations was that of the H. P. Downey Construction Co., of Hammond, Ind., in laying 8.2 mi. of 40-ft. pavement in 20-ft. strips, with two mixers of widely divergent efficiencies working in parallel combination. This mixer team paved 3.6 mi. on section B, for which Barnes Bros. & Co., of Gary, were principal contractors, and 4.6 mi. on Section C, for which the H. P. Downey Construction Co. was the general contractor. Two set-ups of the material-handling plant were used to supply the mixers. All hauling from the plants was done by one- and two-batch trucks.

Teaming up of two mixers of unequal efficiency caused awkward operation and reduced the overall efficiency of the job. Both the mixers were standard 27-E size; but one was an old Koehring which had already passed a long period of construction service and which was much slower than its modern, 1931 model, fast-charging

TWO GASOLINE CRAWLER CRANES, advancing side by side, excavate swamp muck to solid bottom and build fill by rehandling trainloads of sand dumped behind them. Highway crosses two swamps on fills constructed in this way. L. E. BARNES, *(left, above)*, of Barnes Bros. & Co., and H. P. DOWNEY, of H. P. Downey Construction Co.

CRAWLER SHOVEL loads train of V-type dump cars with sand for swamp fill.

C. H. SWEENEY *(left)*, project engineer, Indiana state highway commission.

Rex companion. The narrow width of the old machine made it possible to operate the two mixers in the 20-ft. strip; two of the new Rex pavers could not be fitted into this space. The two mixers were supplied with water from one line, and, for this purpose, were connected by a hose which made it necessary for them to move forward in unison. Water was delivered to the Rex paver, which was equipped with a bypass, and passed from it to the Koehring, which was not so equipped. Two pumps, a Rex and a Barnes, delivered 80 gal. per minute each to a 2½-in. pipe line. Pressure in this line varied from 400 lb. to 250 lb. per sq.in.

Although the overall efficiency of the plant was reduced by parallel operation of the two pavers, the saving in payroll expense was sufficient to cause the contractor to favor this method. Two Lakewood finishing machines were used behind the dual pavers, and the crew was increased by one puddler, one man on subgrade ahead of the

TWO MIXERS, operated in parallel, pave 40-ft. road in 20-ft. strips. On sandy sections, timber mat is used in front of pavers to keep trucks from rutting subgrade. Tractor draws mat ahead when pavers advance.

PITS UNDER TRACKS permit gravity discharge from hopper-bottom cars at first plant set-up.

planer, and one placing concrete in front of the second finisher. Labor required for curing concrete and moving forms was only slightly greater for two pavers in parallel than for one mixer operating individually. Work on the water line was reduced by practically one-half.

Efficiency—When operating individually, the mixers ran as much as 2,035 lin.ft., total, of 20-ft. slab per day. In the parallel combination, they averaged less than 1,700 lin.ft. per day. When working in parallel the lowering of efficiency caused by difference in mixer speeds was marked. On representative days, for example, while the new machine was mixing 405, 484 and 480 batches, the old paver was turning out 271, 286 and 226 batches. These figures indicate extremely irregular production on the part of the old mixer. The new machine, because of its faster operation, carried most of the load, and it nearly always mixed the last batch before the two pavers moved ahead. The old mixer often stood idle while this last batch was being mixed and placed.

Using the specified mixing period of 1 min., and allowing 15 sec. for charging and discharging the old mixer and 20 sec. for the same operations with the old, the maximum possible production of the two machines would be 93 batches an hour, or 1,109 batches in a 13-hr. day. Based on this assumption, the two pavers in parallel operated at an efficiency of only about 70 per cent. In the opinion of the contractor, the saving in labor more than compensated for the loss in efficiency; but this contention is open to dispute.

By paving in half widths of 20 ft. each, the contractor was able to keep the hauling units off the subgrade. Although both one- and two-batch trucks were used, the one-batch size was much preferred. Two trucks, after dumping into the mixer skips, had to drive off the subgrade on to the adjoining 20-ft. strip of grade or pavement. When a two-batch truck, delivering to the inside mixer, had to wait to discharge its second batch, it impeded the departure and arrival of trucks delivering to the outside mixer.

This interference was particularly marked when the trucks had to back up to the mixer skip over a timber mat, which the contractor used to prevent rutting of the subgrade where the soil was sandy. The mat, which was drawn forward by a tractor each time the mixers moved ahead, could not conveniently be made large enough to permit easy maneuvering of the outside truck past an inside truck. On clay subgrade, where no mat was needed, the delay caused by multi-batch trucks was less noticeable.

TWO CRANES handle aggregates directly from cars to bins at second set-up of material-handling plant. Layout requires trucks to back under each bin.

Batching Plants—Each material-handling set-up consisted of two separate Johnson bids, equipped with hoppers for weight measuring, and two cranes operating clamshell buckets.

A Marion steam crane with a ¾-yd. bucket delivered sand to one of the bins, and a Northwest gasoline machine with a 1¼-yd. bucket handled crushed limestone rock into the second bin. At plant No. 1, on the New York Central siding, the hopper-bottom freight cars discharged into pits underneath the tracks, from which the cranes transferred the material to the bins or stock piles. At the second plant set-up, on the Michigan Central Railroad, no pits were used, the cranes unloading from the cars.

Cement, bought by the state, was hauled by truck and trailer from the

CEMENT FROM MILL is hauled by trucks and trailers and is stored on open platforms covered by waterproof tarpaulins.

TWO FINISHING MACHINES follow dual pavers. Crew behind mixers is increased over single-unit force by one man on subgrade ahead of planer, one puddler, and one workman placing concrete in front of second finishing machine.

mill at Buffington, Ind. The largest truck-and-trailer unit transported a total load of 420 sacks. At the plant the cement was stacked on platforms built level with the truck bodies.

At Plant No. 2, the material bins and cement platforms were arranged in a straight line; but the bins were so turned that the trucks had to back under each of them. After taking on its load of sand and stone, the truck stopped at the cement platform where workmen placed seven bags on each batch. At No. 1 set-up, the trucks drove straight through the openings under the bins.

Building Fill in Swamp—Grading for the new road was comparatively light; but in two places on sections D and E, for which M. D. Heiny, of Gary, was general contractor, it crossed swamps which called for considerable ingenuity on the part of the grading forces in building fills. As the swamps are extremely soft and treacherous in the spring and summer, the contractor performed the grading work on these sections in winter, while the ground was frozen.

The method of excavating the swamp muck to solid bottom and replacing it with sand fill consisted essentially of side-casting the excavated material with two cranes operating clamshell buckets and of rehandling trainloads of sand and gravel into the excavated trench with the same machines. Two Northwest gasoline crawler cranes, equipped with 1¼-yd. clamshell buckets, dug and side-cast the swamp muck and then placed the fill material by swinging through 180 deg. with each bucket-load. The cranes advanced on the fill which they were building, and the narrow-gage railway track that delivered the sand was extended close behind them as the work progressed.

A Northwest 1-yd. gasoline crawler shovel excavated sand and gravel for the fill from a nearby cut and loaded it into nine-car trains of Western and Easton 1½-yd. V-type roll-over dump cars. Three of these trains, each drawn by a Whitcomb gasoline dinkey, were kept in continuous operation, one train being in transit while the others were loading and dumping. The maximum haul was approximately 3,000 ft.

The swamp beds varied in length and depth, the first being 1,900 ft. long and up to 17 ft. deep; the second was somewhat shorter and shallower. Working in the manner described, the two cranes excavated 800 yd. of muck and placed 1,100 yd. of sand and gravel per day. In the first 16 days of the operation, when the haul was comparatively short, they removed 10,000 yd. of muck and deposited 16,000 yd. of material for the fill.

Administration—J. J. Brown is director for the Indiana state highway commission; W. J. Titus, chief engineer; J. T. Hallett, assistant chief engineer in charge of roads; and W. J. Bookwalter, road engineer. Construction of the Dunes relief highway was supervised directly by W. E. Mendenhall, field engineer. C. H. Sweeney, project engineer, was in charge of the paving work described in this article.

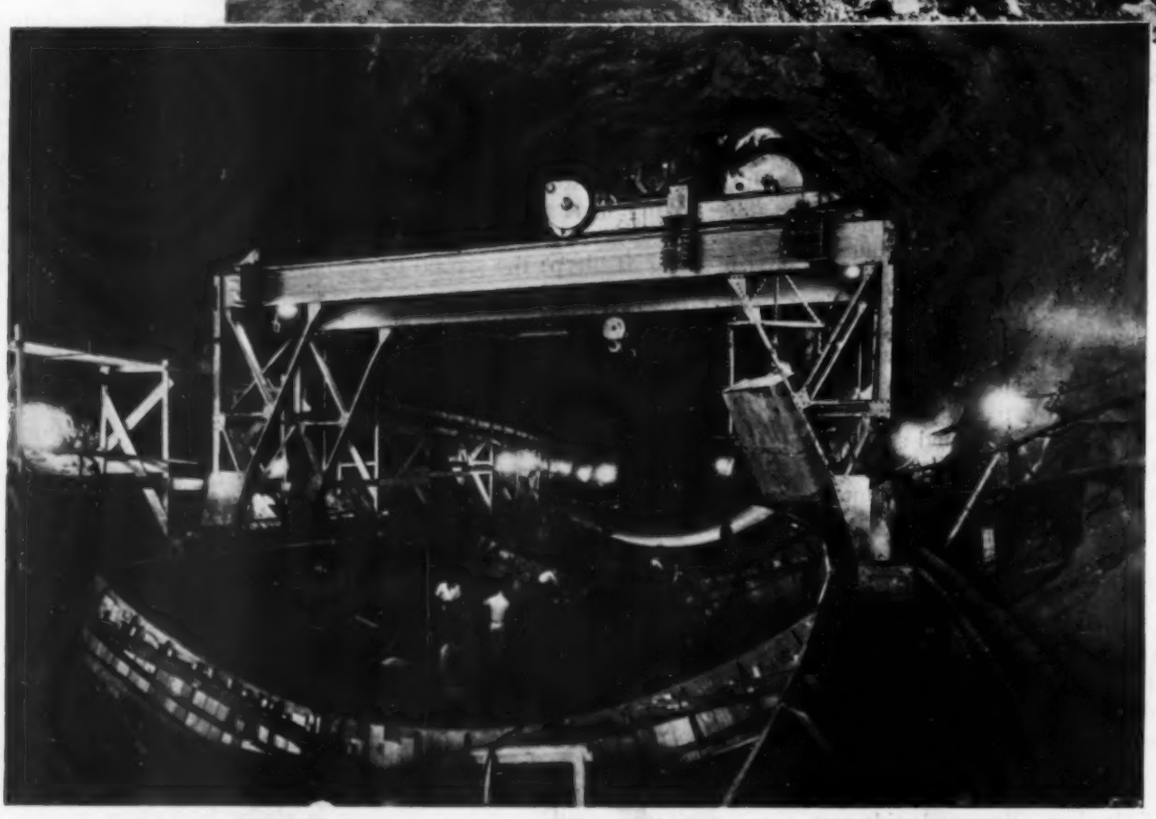
MOVABLE BRIDGE aids curing crew in placing burlap kept wet first day. Slab then is covered with straw kept wet 10 days. Five men are employed on water distribution—wetting burlap and straw, sprinkling subgrade, and moving mixer connections.

Construction Progress at HOOVER DAM

MOTOR TRUCKS *(left)*, equipped with seats, are operated by Six Companies, Inc., to transport men from Boulder City to site of Hoover dam on Colorado River. Each bus carries 45 workers.

U. S. Bureau of Reclamation

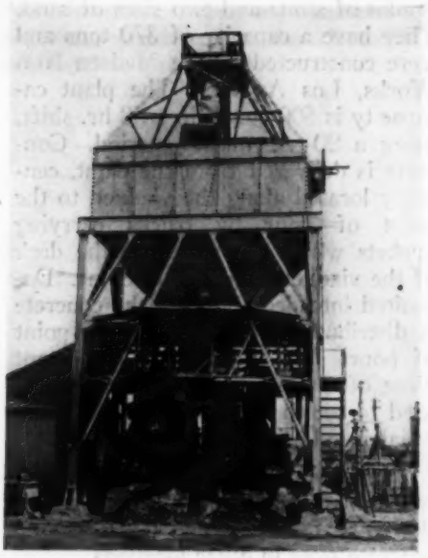
TUNNEL MUCK *(right)* is loaded into motor trucks at headings and carried to transfer dock in specially reinforced bodies, designed to stand up under rough usage. Hoods over truck engines are protected from falling rock by heavy wire screens.



PLACING CONCRETE in invert section of one of 56-ft. diameter diversion tunnels. Electric gantry crane, riding on tracks supported by sills along sides of bore, picks up hopper bucket filled with concrete delivered by motor trucks with agitator bodies. Power for crane is supplied by trolley wire on scaffolding.

COLUMN FORMS, *Sawed in Half, Are* PLACED BY CRANE

J. F. Knapp, Contractor, Follows Special Procedure on $2,500,000 Sixth St. Viaduct in Los Angeles



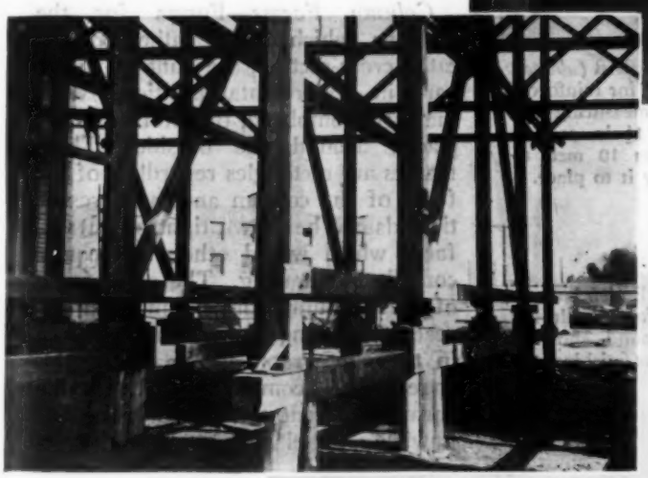
CONCRETING PLANT, with two 1-yd. mixers, has capacity of 500 cu.yd. per 8-hr. shift.

RAPID progress is being made by J. F. Knapp, general contractor, on the $2,500,000 bridge and viaduct project across the Los Angeles River at Los Angeles. The structure will have a total length of 3,546 ft., and will extend Sixth Street across the river to provide an important new traffic outlet. Except for two 149-ft. bowstring steel arches across the river bed, the structure is a reinforced concrete viaduct of girder construction. Work was begun in June, 1931, and is scheduled for completion by the end of this year.

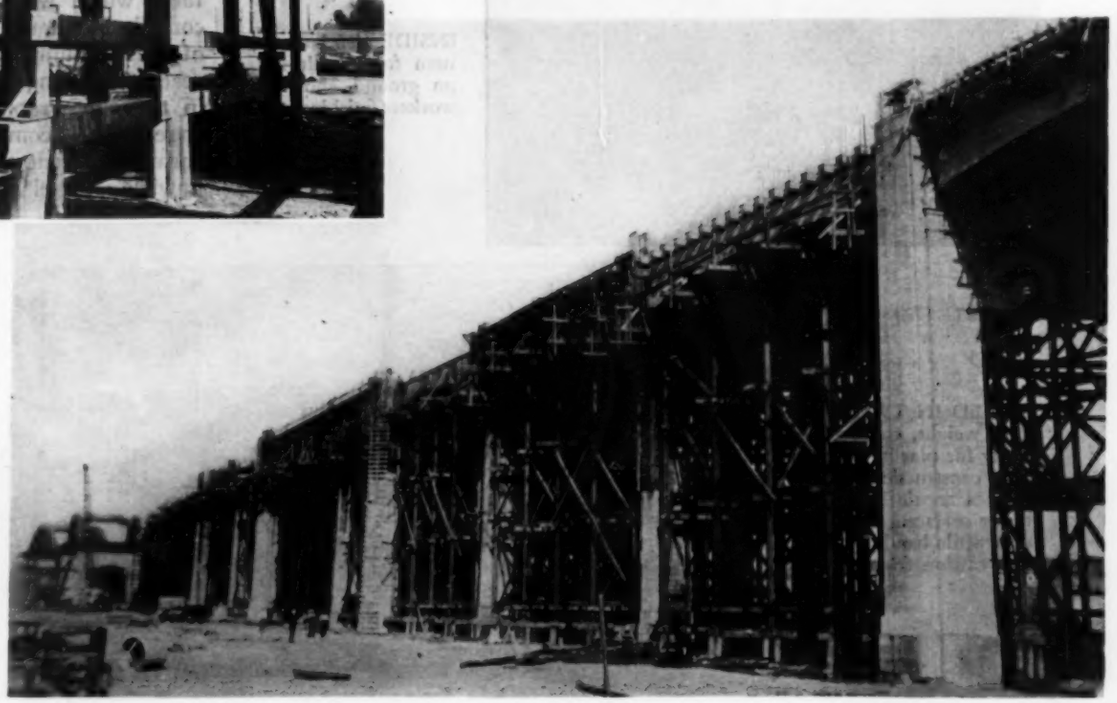
The project is being paid for as a municipal, county and railroad improvement. The city and county of Los Angeles each pay half of 75 per cent of the cost and the Union Pacific and Santa Fe railroads divide the remaining 25 per cent. The viaduct will provid clearance over all existing railway tracks and streets. In fact, the design required special provisions to give clearance for future expansion of railroad facilities near the river.

Approaches to the viaduct have 56-ft. roadway widths with a 46-ft. width on the viaduct.

Plant—The contractor's concrete plant includes two 1-yd. Jaeger mixers. Material arrives in railway cars and is placed in overhead bins by bucket conveyor. Bunkers provide for three



SMOOTH FINISH on concrete girders is result of careful form work.



PILES support all falsework for concrete girder spans.

FALSEWORK *(right)* in position for carrying forms. Stripped girders at right.

grades of stone and two sizes of sand. They have a capacity of 370 tons and were constructed by the Madsen Iron Works, Los Angeles. The plant ca-capacity is 500 cu.yd. in an 8-hr. shift, using a 90-sec. mixing period. Concrete is delivered from the plant, centrally located along the viaduct, to the point of pour by trucks carrying buckets which are raised to the deck of the viaduct by a P & H crane. Deposited into deck hoppers the concrete is distributed by buggies to the point of pour. The crane is an important piece of equipment on the job and is used to set the forms and handle material in addition to concrete.

Foundation—Piers for the viaduct rest on spread footings where conditions are favorable and on Raymond concrete piles in other locations.

Falsework—All falsework for the viaduct section of the structure is supported on wooden piles. Detail of this falsework support and framing is illustrated. These temporary piles are short and are pulled for redriving after forms can be removed from the section.

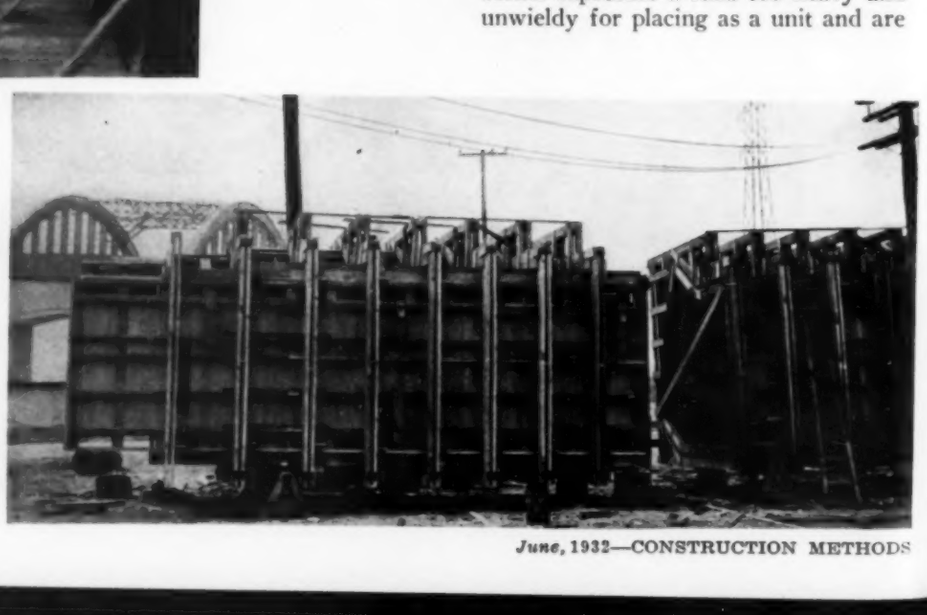
COLUMN FORMS *(right)* are built in horizontal position at contractor's yard. Note yokes and bracing on outside.

Sills resting on the piles support the posts which are crossbraced and tied together at the bottom with steel rods. Forms resting on this falsework are built up in sections in the yard which eliminates much of the formwork otherwise required on the deck. Particular care is taken with the forms and certain exposed sections are built up of tongue-and-groove material. Careful inspection is made of the forms before pouring and any cracks which appear are either tightened up or filled with plaster-of-paris. As a result, the exterior finish is exceptionally good.

Column Forms—Forms for the columns, which are of rather complicated cross-section, are built up in the yard in a horizontal position. With the form completed, timber frames are placed around the outside. These frames are rectangles regardless of the form of the column and, as a result, tie-rods can be drawn tight on parallel faces which would otherwise require complicated bracing. The end of one of these column forms completed and ready for lifting into position is shown in the photograph at the top of this page. When completed, these column forms represent a load too heavy and unwieldy for placing as a unit and are

LONG BAR *(above)* of steel for reinforcement, measuring 100 ft. by 1¼ in. square, requires 10 men to carry it to place.

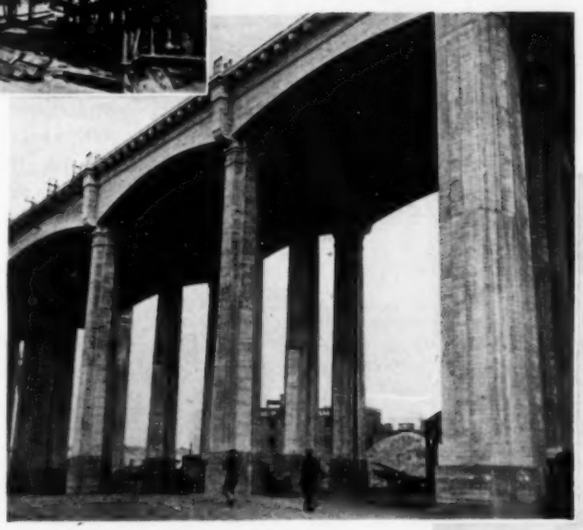
INSIDE *(left)* of column form built flat on ground, showing workers finishing surface.



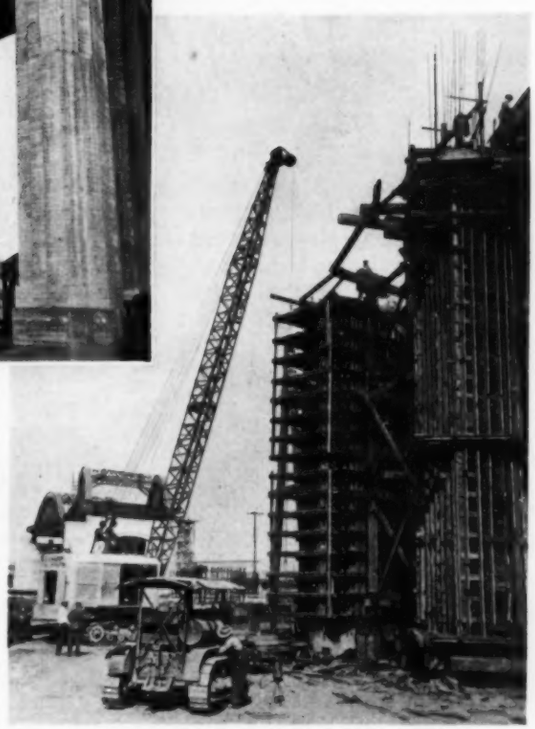
SAWED IN TWO *(right)* to reduce weight, column sections are ready for placing by crane. Original construction in single unit insures regularity of finished interior surface. Danger of distortion while handling is reduced by cutting form in middle.

SPECIAL DESIGN of falsework at crossing of trunk sewer line where A-frames are used instead of vertical posts.

UNSYMMETRICAL bowstring arches, each 149 ft. long, are used at river crossing.



COMPLETED SECTION of viaduct structure *(right)* with railing remaining to be placed.



COLUMN FORMS *(right)* have been placed by crane and are ready to receive concrete.

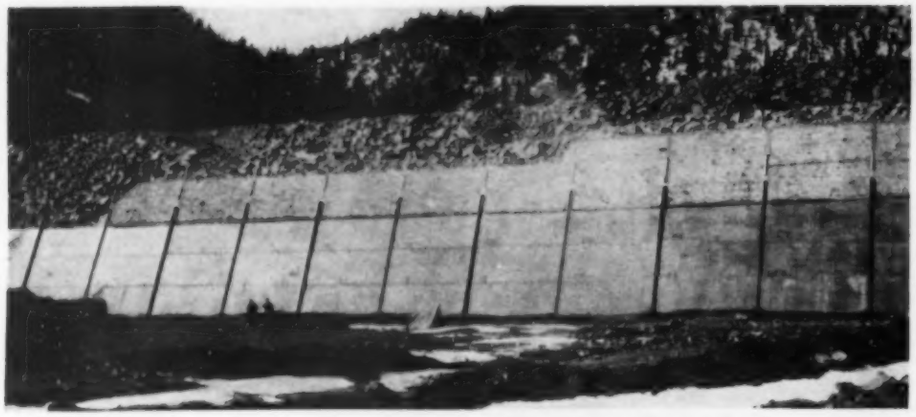
therefore cut in half for placing in position.

Design—Viaduct spans are continuous reinforced concrete girders from two to four spans in length between expansion joints. The soffits of girders are curved and the variable depth was taken into account in design. The resulting greater depth over the piers produced larger negative moment at these points with accompanying decrease in positive moment at the span centers.

The series of three girder spans immediately east of the steel arch river crossing includes girders 88, 123, and 88 ft. in length. This three-span section, and the corresponding three-span unit on the other side are built with a key section at the center of the middle span. Reinforcing steel is lapped in this section and the key is not poured until falsework has been removed and the structure loaded with material to equal full dead load. As a result, there is no stress in the key section when poured. Thus, the only stresses occurring in this center section of the 123-ft. girder span will be those resulting from live load. In this design, the length of the cantilever arms is 56½ ft., the length of the key system 10 ft., its depth 5 ft. 6 in., and the depth of the girders over the intermediate piers is 13½ ft.

Contract—In addition to the general contract awarded to J. F. Knapp, Oakland, Calif., a separate contract was awarded to the Virginia Bridge & Iron Co. for fabricating the 1,245 tons of structural steel in the river arches. The bid for this fabrication was $112,330. Allen Bros., Inc., Los Angeles, who bid $35,368, was awarded the contract for the erection of steel in the river span. The general contractor's bid for the 47,310 cu.yd. of 1:2:3 concrete in the structure was $16 per cubic yard, in place. The bid for the 4,200 tons of reinforcing steel in the viaduct was a lump sum of $302,000 in place.

The work is being done under the direction of the city engineer's office. J. J. Jessup is city engineer of Los Angeles and Merrill Butler is bridge engineer. L. E. Meidroth is chief inspector. The general contract is held by J. F. Knapp, Oakland, Calif., and is being carried out under his personal direction.



WATERTIGHT DIAPHRAGM across face of dam is formed by welded steel plates.

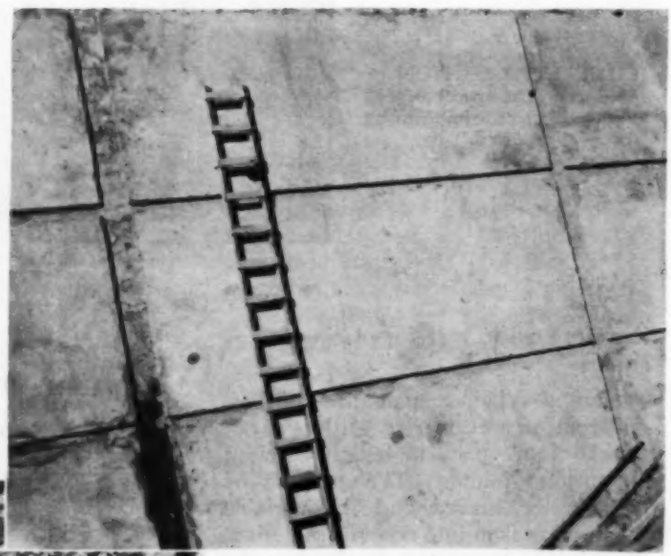
WELDED STEEL PLATES

Form Watertight Facing on Rockfill Dam

STEEL plates 20 ft. long, 8½ ft. wide, and from ¼ to ⅜ in. thick, welded along both horizontal and vertical joints as well as at all assembling bolts, form a water tight facing on the upstream side of the rockfill dam built across the canyon of East Beaver Creek to store water for the use of the Broadmoor Hotel at Colorado Springs, Colo. The new steel-faced dam is 580 ft. long on top and 100 ft. high from the bottom of the toe wall to the crest. The main body of the structure, which is built at slopes of 1 on 1.4 on the downstream side and 1 on ½ on the upstream side, is a loose rockfill obtained from a quarry below the dam site. Rock for the fill was obtained in sizes ranging from fines up to 5 cu.yd. and was loaded by a steam shovel into trucks which delivered it for dumping at the dam.

The upstream side of the dam is in the form of a dry rubble wall of 3- to 5-cu.yd. rocks placed by derrick and by hand, all voids being filled with small stones pounded into place. This wall, 12.5 ft. wide at the base and 4 ft. wide at the top, served as a backing for a rubble masonry facing wall laid up in cement and sand mortar. The facing wall has a bottom width of 4 ft. decreasing to 2 ft. at the top of the dam. To serve as a bed for receiving the steel-plate facing, the face of the upstream rubble wall is coated with a 2-in. thickness of cement and sand mortar. This mortar facing was finished off flush with timbers placed along the lines of both the vertical and horizontal joints of the steel plates so that when the timbers were removed, grooves were cast to provide clearance for the bolt heads of the steel diaphragm. Along the upstream toe of the dam a cutoff trench was excavated in solid granite to a depth of 6 ft. and filled with concrete, which was later made watertight by grouting through rows of 2½-in. pipe which had been set vertically before pouring was begun.

The steel plates forming a watertight diaphragm across the entire face of the dam are lapped 2½ in. along the line of the longitudinal joints and are bolted together as a preliminary to the welding of all seams. In connecting up the plates along both vertical and longitudinal joints, ¾-in. bolts are placed at intervals of 18 in. At one



GROOVES *(right)* in 2-in. cement mortar covering of rubble wall provide clearance for bolt heads of steel plates.

ROCK FILL *(below)* in sizes up to 5 cu.yd. is placed across river canyon in lifts of 14 to 16 ft.

end of each steel plate is a contraction joint and at the other a vertical joint formed by bolting adjacent plates to a 6½x6½-in. tee. The contraction joints are spaced 40 ft. 7 in. apart.

The procedure in erecting the steel-plate facing was as follows: When the rubble masonry face had reached a height of 30 ft., the bottom row of plates, loosely bolted together, was lowered into place along the toe wall. These lower plates rested upon protruding Z-bars. The plates were then bolted loosely together, after which the second and third rows of facing plates were lowered and loosely bolted. The steel diaphragm was then pushed away from the masonry backing and workmen were lowered, one between the face of the dam and the plates to hold the bolt and one outside to set the nut. This operation was continued until all bolts were given their final set, after which all joints and all bolt heads and anchor coverings were made watertight by arc-welding. At all longitudinal joints the top of the lower plate was lapped over the bottom edge of the upper plate, thus making all welds top welds.

VERTICAL JOINT between plates is made with aid of 6½x6½-in. tee.

UPSTREAM FACE of dam consists of a rubble masonry wall laid up in cement and sand mortar against which steel-plate diaphragm is anchored.

STEEL PLATES, loosely bolted together, are lowered over dam face and made watertight by arc-welding of all joints and assembling bolt heads.

At 40-ft. 7-in. intervals anchor bolts were set in drilled holes to hold the steel plate facing against the rubble masonry wall. These bolts, ¾-in. in diameter, extend through 2¼-in. holes in the steel plates, with a 4¼-in. washer on the outside face. This method of attachment insures a play of 1½ in. between the anchor bolt and the steel plate facing.

From the dam water is delivered to the Broadmoor Hotel through a 12¾-mile steel pipe line.

The contractor on the work was Edward H. Honnen, of Colorado Springs. The design was prepared by H. I. Reid, consulting engineer, and J. H. Sanford, who served also in the capacity of construction engineer in charge of field work.

COMING

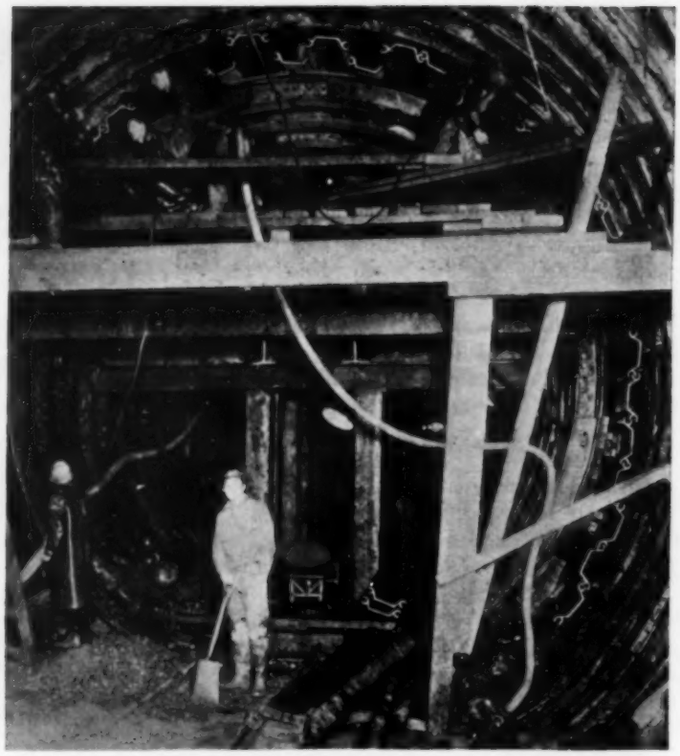
Two illustrated articles on the Hoover dam by *Construction Methods'* Pacific Coast editor:

One describes the big aggregate plant for handling the sand and gravel required for the concrete work.

The other tells how the 56-ft. diameter diversion tunnels are being driven through rock.

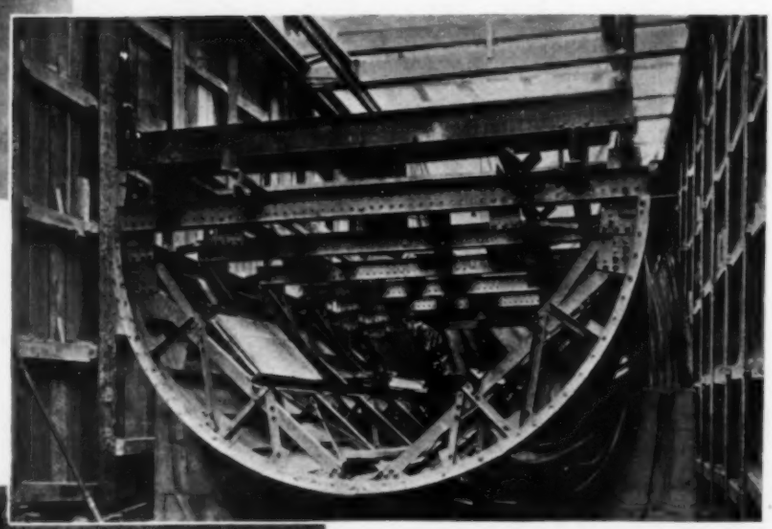
Getting Down to DETAILS

Close-up Shots of Job Methods and Equipment

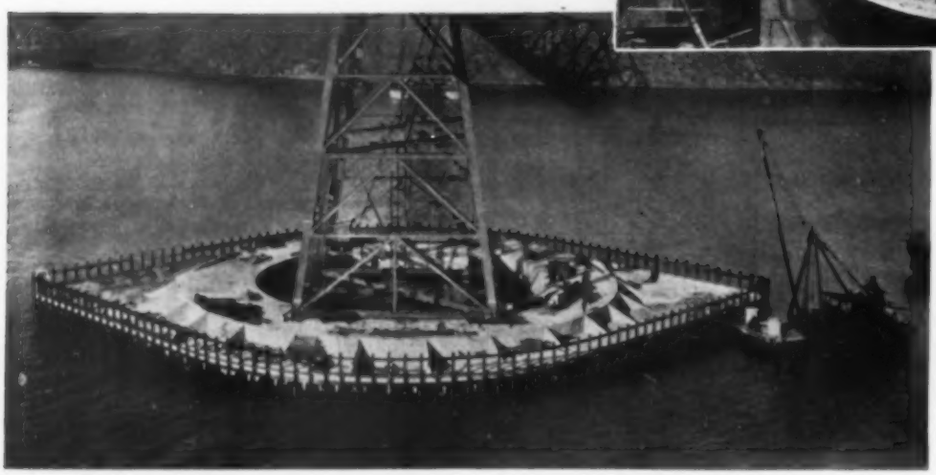


SHIELD OF STEEL SHEETPILING, driven horizontally, carries 24-ft. diameter section of New York water tunnel No. 2 through short fault zone under Bronx River. On contract of Patrick McGovern, Inc., 58-lb. arch web piles, 30 ft. long, are supported by rings of 10-in. H-beams. Center posting carries needle beams used to support roof during second stage of driving.

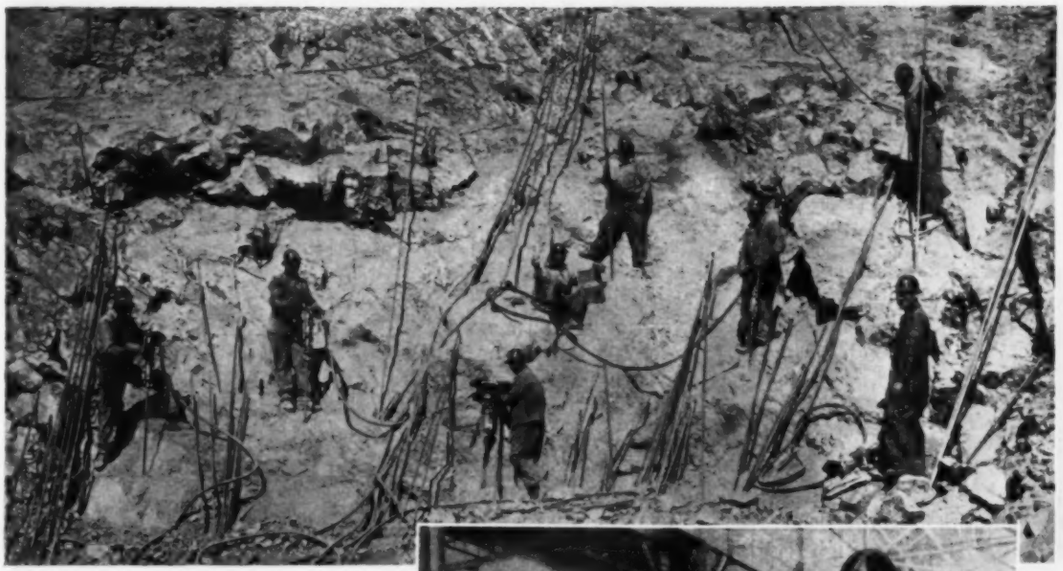
NON-TELESCOPIC ARCH FORM in place for concreting 13½x23½-ft. Mill Creek intercepting sewer at Louisville, Ky. Arundel Corp., contractor, of Baltimore, Md., uses carriage traveling on rails to handle Blaw-Knox steel sections for egg-shaped interceptor being built under $10,000,000 bond issue.



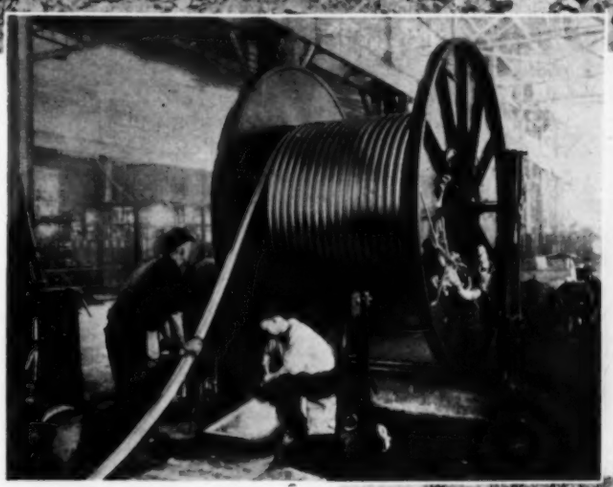
INVERT FORMS for 13½x20½-ft. section of Mill Creek intercepting sewer at Louisville, Ky. Blaw-Knox steel units, used by Arundel Corp. of Baltimore, contractor, are moved by raising them away from the concrete on I-beam trolley.



FENDER PROTECTION erected by Healy-Tibbetts Construction Co. around central pier of Carquinez highway toll-bridge across upper arm of San Francisco bay. To prevent damage to pier by ships 200,000 tons of rock were placed in water 100 ft. deep and 454 reinforced concrete piles were driven to carry concrete girder and wharf structure.

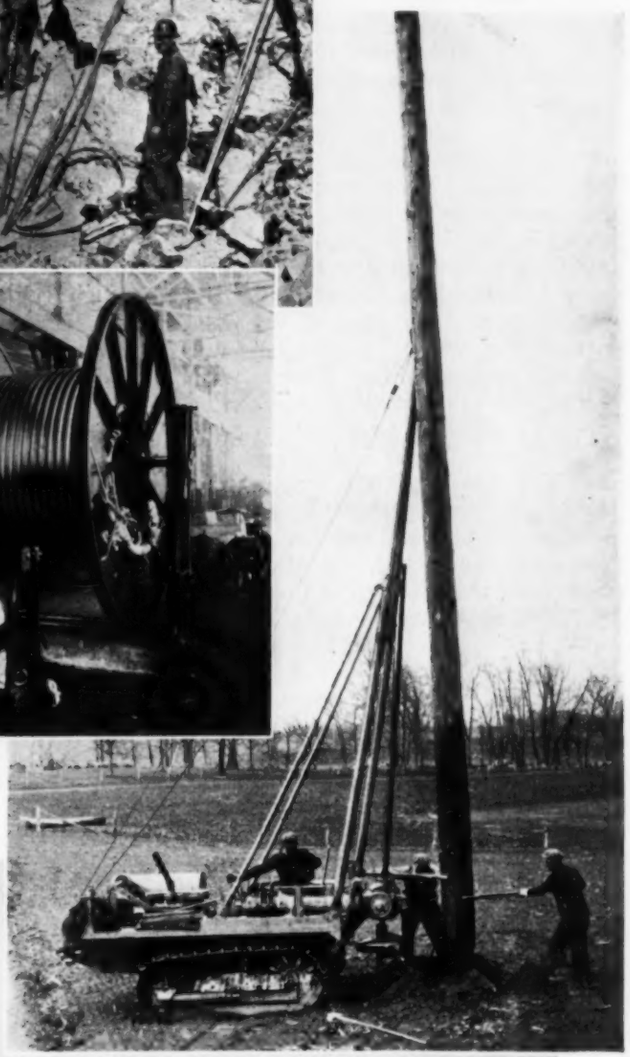


HARD-BOILED HATS protect heads of rock drillers and tunnel workers at Hoover dam. Six Companies, Inc., contractor on $49,000,000 Boulder Canyon project of the U. S. Bureau of Reclamation, purchased 4,000 of these Bullard head coverings as an accident prevention measure.



MIRROR *(right)* simplifies inspection of under side of oil-filled submarine cable before shipment from shops of General Electric Co. for use by Northwestern Electric Co. at Columbia River crossing.

POST-HOLE DIGGER *(below)* on Caterpillar tractor is equipped, also, to set poles with aid of A-frame.



MASTIC CUSHION COURSE laid to support brick pavement for resurfacing 18-mi. section of concrete highway between Mitchell and Staunton, Ill. McCarthy Improvement Co.'s mixer, on subgrade, pulls double screed which spreads and strikes off sand-mastic material. Roller operates between screeds.

Unusual Sewer Job Demands

SPECIAL FORMS

A REINFORCED-CONCRETE sewer of unusual, if not of entirely new, design, across a portion of the Flushing meadows in the Borough of Queens, New York City, required special forms for its construction. By the skilful use of a short section of steel forms, Kennedy & Smith, Inc., of Flushing, contractor, has made rapid progress. The entire contract calls for 2,804 ft. of circular reinforced-concrete sewer, from 66 in. to 54 in. in diameter, and more than 2,200 ft. of lateral sewers. Preliminary investigations indicated that the special type of construction would be needed for 957 ft. of 54-in. sewer across the meadows. Recent wash borings have shown that this section probably will have to be extended.

Originating as a tidal swamp, the Flushing meadows today consist of a soft muck deposit about 50 ft. thick resting on a solid sand bottom. To cross this muck bed, the Bureau of Sewers of the Borough of Queens designed a sewer resting on pile bents, with solid reinforced-concrete arches to carry the sewer barrel between bents. The arches are poured monolithically with the lower half of the sewer, up to the horizontal diameter.

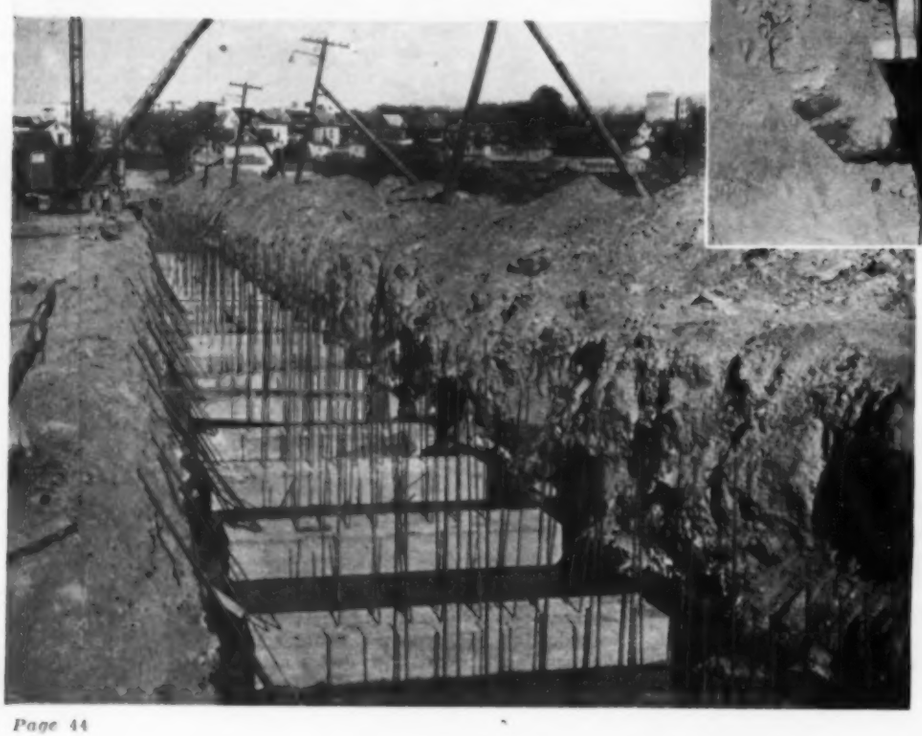
A hard-surfaced road crossed the meadows on the line of the sewer. The surface of the swamp is approximately at El. 1.7, and the pavement was at El. 3.0. Average level of the sewer invert across the swamp is at El. 8.5. Embankment is to be placed to a height about 4 ft. above the top of the sewer, and the street is to be repaved at this new grade, as part of the Kennedy & Smith contract.

Pile Bents—Before beginning construction of the sewer, the contractor, acting on the suggestion of the borough engineer, placed fill on top of the highway to El. 6.5, on the theory that this fill would help to stabilize the surface along the right-of-way while the sewer was being built. A trench was cut in the fill approximately to El-1.0, with bell holes at the locations of the bents, spaced 10 ft., c. to c. The photographs illustrate the construction of the pile bents and concrete piers.

Five wood piles 60 ft. long were driven to refusal in the sand bottom at each bent, with the two outside piles battered to prevent shifting of the bents and sewer. The piles were cut off at El. 1.0, below groundwater level. On each bent were cast a reinforced-concrete cap and pier rising to the springing line of the arch. Ends of the longitudinal arch steel were embedded in the tops of the piers.

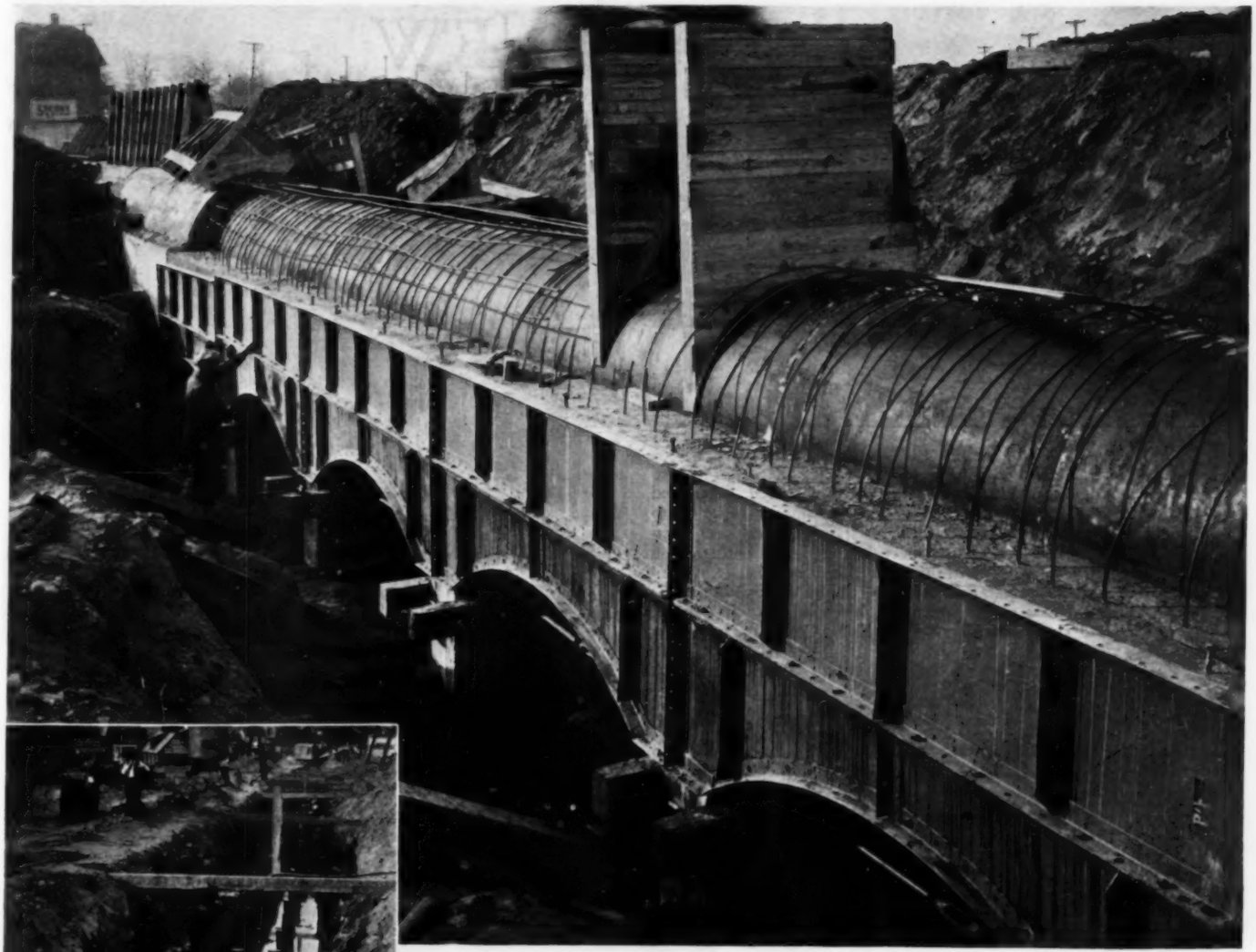
CONCRETE PIER 8 ft. long by 16 in. wide by 4½ ft. high is poured on cap to springing line of arch. Ends of arch steel are embedded in piers.

CONCRETE CAP *(below)* 12 ft. long by 2½ ft. wide by 2 ft. 4 in. high is cast on each pile bent.

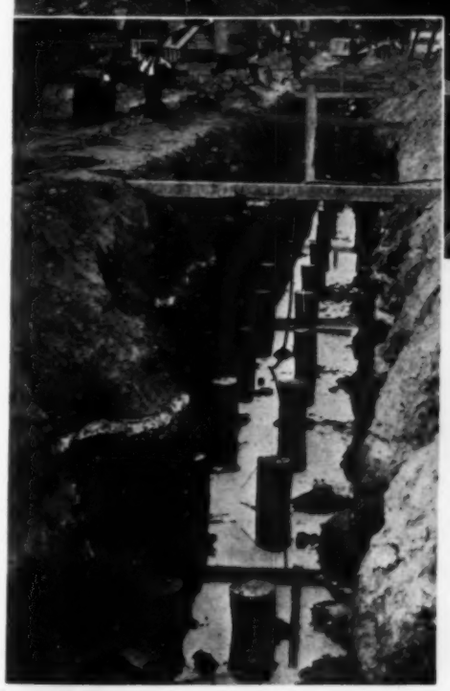


Construction of the arches and of the sewer barrel presented opportunities for repeated use of forms. The width of the arches is 8 ft., the same as the piers, and the rise is 18 in. in a clear span of 8 ft. 8 in. Outside walls of the sewer rise vertically from the spandrel walls of the arch to the horizontal diameter. At this point, the cross-section is stepped in 9 in. at each side. The outside of the upper half of the sewer is rounded, the thickness of the barrel varying from 12 in. at the shoulder to 6 in. at the crown.

Forms—Steel forms for the arches,



STEEL FORMS for five arches rest on 6x8-in. timbers bolted to concrete piers. Turnbuckle tierods between form haunches take horizontal thrust. Semicircular inside form has been turned to pour upper half of sewer. Wood forms for outside of upper half rest on completed sewer in background.



EACH BENT has five wood piles 60 ft. long driven to refusal and cut off below water level. Outside piles are battered 2 on 1.

side walls, and inside of the sewer barrel were built by the Blaw-Knox Co. for five spans, or 50 lin.ft. of sewer. The arch forms are supported on 6x8-in. timbers bolted to the piers, as illustrated by one of the photographs, and the haunches of the form are tied together with turnbuckle tierods. Sidewall forms are bolted to the spandrel forms. Steel I-beams across the top of the side-wall forms hold the two sides in position and support the semi-circular invert form. Concrete is placed to the top of the form, on a level with the horizontal diameter of the sewer, and bolts are cast in the 9-in. step at the top of the side wall to serve in the erection of the outside forms for the upper half of the barrel. Ends of the arch steel also are embedded in this pour.

After the invert concrete has hardened, the inside semicircular form is pulled and turned to form the upper half of the sewer. Forms for the outside of the upper half are of wood, in sections 10 ft. long. Each section consists of two halves, and each half is reinforced by vertical and horizontal timbers, as can be observed in one of the photographs. The bolts in the 9-in. shelf at the top of the side wall anchor the outside form at its base, and long threaded rods tie the two halves of the form together at the top.

Progress—Truck-mixed concrete from the Flushing plant of J. & I. O'Rourke is employed exclusively in the construction of the sewer. The contractor has placed fill to a height sufficient for chuting the concrete by gravity from the trucks to the forms. Since operations have become systematized, and with good weather to expedite curing and to permit early stripping of the forms, the builders have been able to average 100 lin.ft. of sewer barrel per week, both upper and lower halves being included in this record. A P&H backfiller, used as a crane, pulls the arch and crown forms and places them for the next pour.

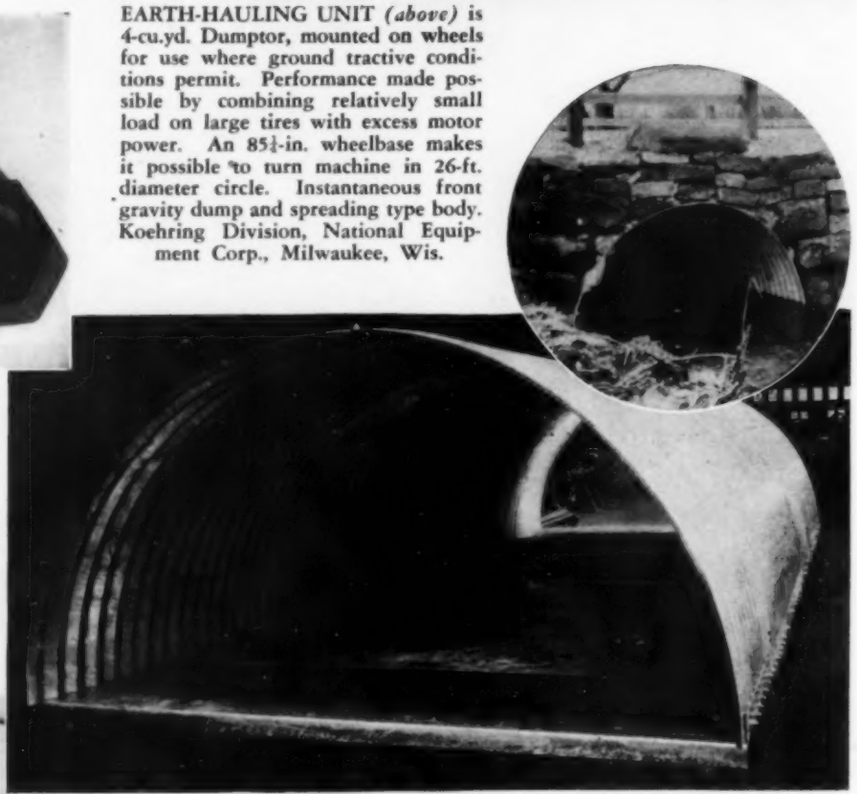
Administration—Frank Street, Jr., directs operations for Kennedy & Smith, Inc. R. W. Avery, who handled the stripping and erection of the steel forms, provided most of the information for this article. For the Borough of Queens, O. Erlandsen is chief engineer, J. F. Perrine is engineer of sewers, and W. H. Bertram is assistant engineer, Bureau of Sewers. Wm. Warren is section engineer in charge of the work, and Joseph McGowan acts as inspector.

NEW EQUIPMENT

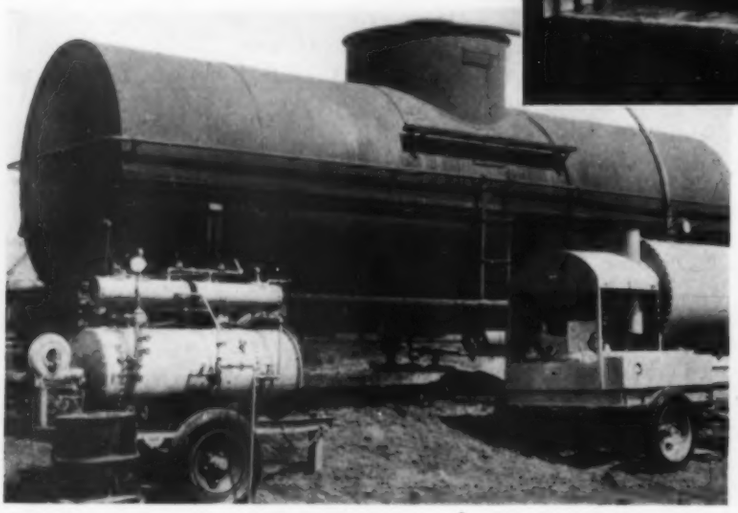
HYDRAULIC BULLDOZER for attachment to all sizes of tractors. Power enclosed in side arms fully protected from dust. Curved bowl, electrically welded, heavily reinforced, supported by two side arms and attached to truck frame, Designed to lift and roll earth, and thus reduce resistance to pushing. Cutting edge of alloy steel. Compact box type of construction enables blades to work within close limits of tractor. Controlled by tractor operator through double-acting hydraulic pump which, with a single control, holds bowl with its cutting edge at any desired elevation.—Blaw-Knox Co., Pittsburgh, Pa.

EARTH-HAULING UNIT *(above)* is 4-cu.yd. Dumptor, mounted on wheels for use where ground tractive conditions permit. Performance made possible by combining relatively small load on large tires with excess motor power. An 85½-in. wheelbase makes it possible to turn machine in 26-ft. diameter circle. Instantaneous front gravity dump and spreading type body. Koehring Division, National Equipment Corp., Milwaukee, Wis.

"RIVET-BOLT," embodying new fastening principle, has standard rivet head and oversized ribbed neck to insure firm, tight grip when driven, cold, with hand hammer into hole. Threaded section has nominal bolt diameter to receive nut recessed to accommodate end of ribbed section when necessary. Tapered faces of screw threads provide self-locking wedging feature when nut is tightened with ordinary wrench. No skilled labor, heating or mechanical equipment required.—Dardelet Threadlock Corp., 120 Broadway, New York City.

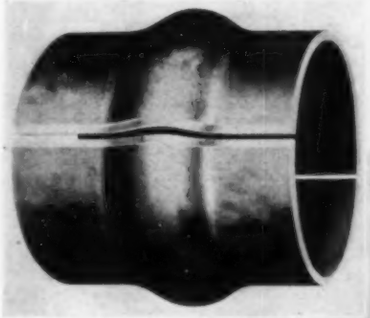


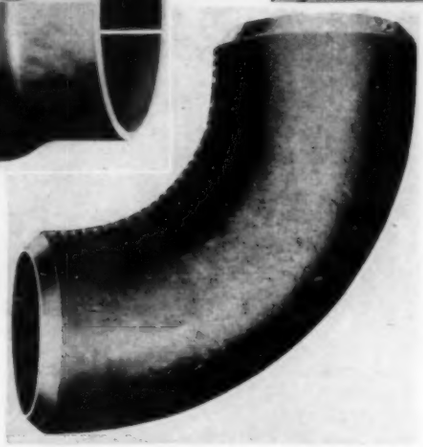
PART-CIRCLE PIPE for drainage structures provides adequate waterway area without headroom necessary for full-round pipe. Fabricated of Armco ingot iron 5- or 3-gage flat base plates, each 30 in. wide, and of arch plates with corrugations 6 in. from crest to crest and 1½ in. deep. Ends of base plates are turned up 4½ in. so that arch can be bolted to base. Spans range from 90 to 220 in. Armco Culvert Manufacturers' Assoc., Middletown, Ohio.



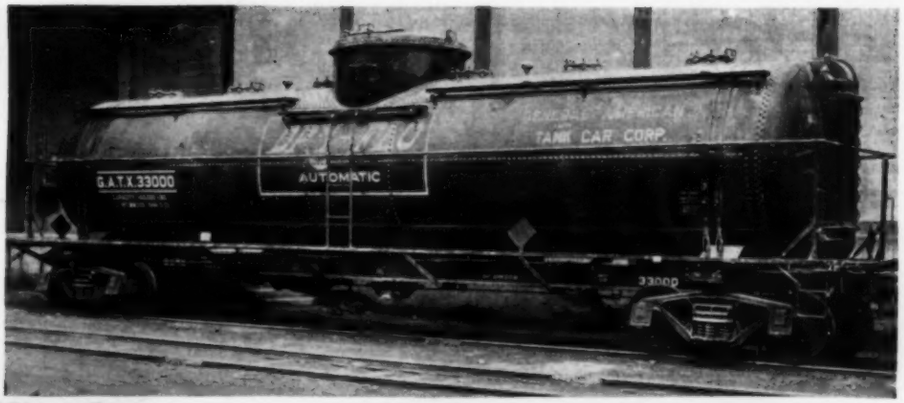
OIL-BURNING LOW-PRESSURE HEATING UNIT for raising temperature of road oils and other bituminous materials from pumping to application temperature. Material is pumped from tank car through a 3-in. line by a 3-in. reversible asphalt pump into the booster-unit *(at right)* which heats it to desired temperature and either returns it to car or transfers it to distributors or tanks. Mounted on two-wheeled trailers or on 1½-ton trucks.—Cleaver-Brooks Co., Milwaukee, Wis.

on the Job





WELDING SLEEVE reinforces butt line weld between two pieces of pipe and relieves it of any bending stress and much of the tensile stress to which it might otherwise be subjected. Transverse recess permits application of sleeve over conventional line weld. Each half of sleeve is slightly less than semicircle to assure snug fit against pipe. WELDING ELLS, 90 and 45 deg., *(above)* made from one piece of plate to exact radius and sectional diameter. One welded longitudinal seam along inner circumference. Final working of metal is in compression. Midwest Piping & Supply Co., Inc., 1450 Second St., St. Louis, Mo.

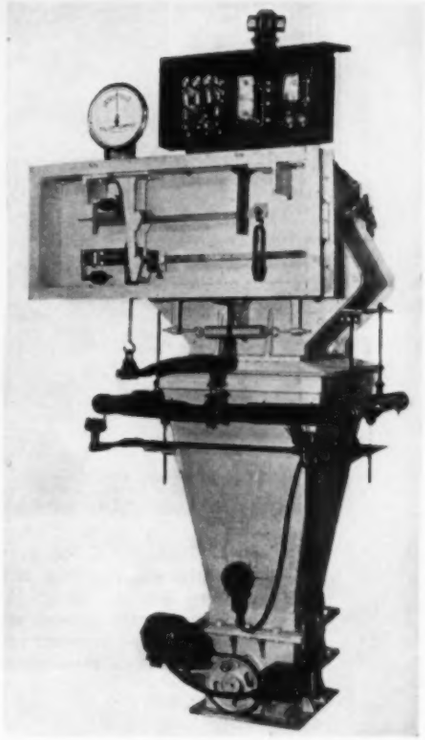


SELF-UNLOADING TANK CAR, of 1,600 cu.ft. capacity, for transportation of cement and other dry, granular commodities in bulk. Divided into three compartments, two of which carry the material and a third which houses unloading machinery. This mechanism consists of power-driven drag chain conveyors which are pulled along toward center outlet at bottom of car by sprockets which automatically unload car completely in less than 2 hr. Car is loaded through six openings in top.—Manufactured by General American Tank Car Corp., in conjunction with Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.

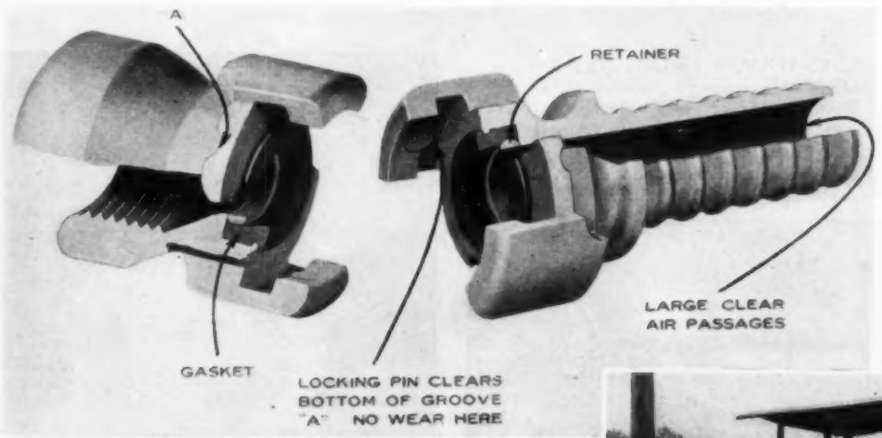
If You Want Further Information—

Within the space limits of these pages it is impossible to present complete information about the products illustrated.

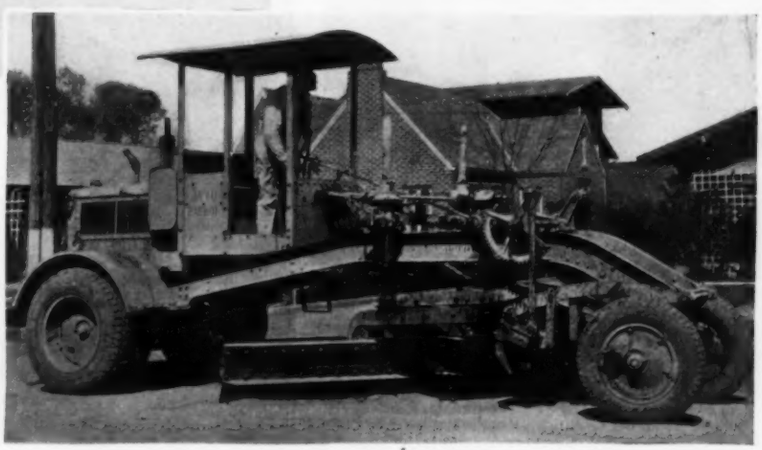
The manufacturers, however, will be glad to supply further details if you will write to them, referring to this issue of *Construction Methods*.



AUTOMATIC WEIGHING BATCHER for bulk cement consists of: (1) Roll feeder driven by built-in motor and speed reducer with magnetically operated brake to prevent over-running. (2) Double-beam scale. (3) Batch hopper. (4) Motor-driven hopper gate discharge (5) Casing with locks to prevent tampering. (6) Operating circuits, including starting and discharge push buttons. Available in sizes suitable for all mixers.—Fuller Co., Catasauqua, Pa.



RUSTLESS HOSE COUPLING in ¼- and ¾-in. sizes, for use on compressed air lines. Turned out of bar steel on automatic machines, strengthened by heat treating and plated with cadmium to prevent rust. Sizes are interchangeable.—Cleveland Rock Drill Co., Cleveland, Ohio.



ROAD BROOM *(right)*, from 8 to 14 ft. wide, for gravel maintenance and oil penetration work. Replacement unit for cutting edge on any standard one-man maintainer or pull-type grader. Moldboard and cutting edge are removed and broom inserted instead. Composed of steel wires 18 or 20 in. long.—Speeder Machinery Corp., 1201 S. Sixth St., W., Cedar Rapids, Iowa.

Present and Accounted For —

A Page of Personalities

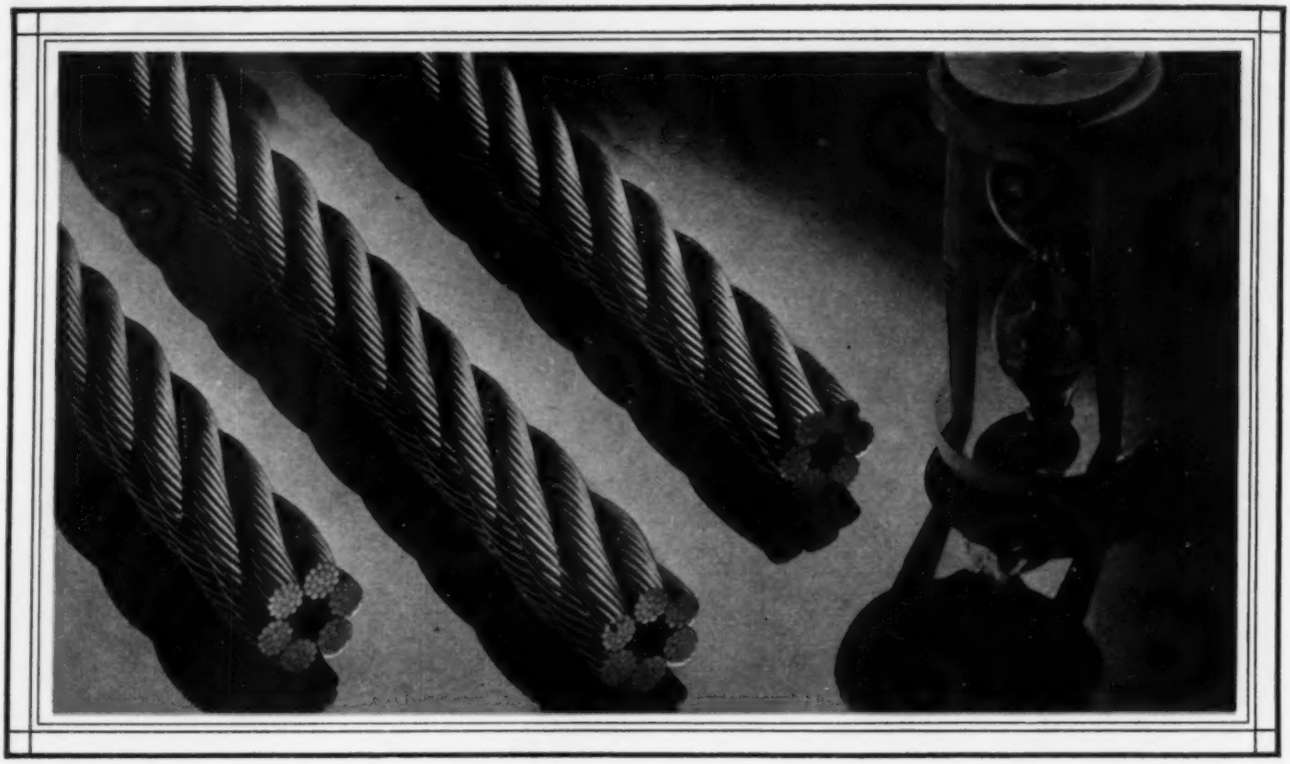
R. H. BALDOCK has been appointed state highway engineer of Oregon succeeding Roy A. Klein. Mr. Baldock had previously served the Highway Commission as assistant state highway engineer and as maintenance engineer.

HENRY J. KAISER, of Oakland, Calif., has been appointed president of the Associated General Contractors of America to fill the vacancy created by the death of Col. William A. Starrett. Mr. Kaiser is vice-president of Six Companies, Inc., contractor for the $49,000,000 Hoover dam now under construction on the Colorado River at Boulder Canyon.

H. H. HALL, of East St. Louis, Ill., is the newly elected president of the Illinois Association of Highway and Municipal Contractors. He is head of the H. H. Hall Construction Co.

L. C. WASON *(below)* president of the Aberthaw Co., contractor of Boston, Mass., was elected to honorary membership in the American Concrete Institute at its recent annual convention.

GEORGE W. PRACY, superintendent of city distribution for the San Francisco Water Department, has been elected to the presidency of the American Water Works Association.



What is the *True* MEASURE of Wire Rope service?

Variations in rope life are experienced by practically every rope user. Ropes encounter varying service circumstances. Operating conditions, as well as rope maintenance and equipment conditions, change from time to time, even on the same piece of equipment. As a result, rope life varies too.

It is easy, therefore, to see why the service given by a single rope is not necessarily a criterion of the *general* service that make or design of rope will provide.

Many years of experience and close contact with thousands of diversified installations of wire rope have convinced this company that there is only one fair and reliable basis on which to compare the service of wire ropes:—the basis of *average* service.

Roebling is glad to have its ropes put to this severe test. It advocates the "Average Service" method of determining rope cost, in which cost per ton of material handled, mile traveled, or other measuring unit, is based not merely on the service of a single rope but on the *average* service of several ropes.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON, N. J.

Wire · Wire Rope · Copper & Insulated Wires & Cables · Welding Wire · Flat Wire · Wire Cloth & Wire Netting

Branches in Principal Cities — Export Dept.—New York, N.Y.

A plain statement about Wire Rope Economy

Roebling does not indulge in nor encourage sweeping claims of superior wire rope economy. Such claims, if generally made, would merely confuse the rope user. ¶ For the guidance of rope buyers, however, Roebling does assert that when gauged by the work performed, NO wire rope, regardless of make or construction, will show lower general average operating costs than Roebling.

Wire Rope for all purposes

There is no such thing as a wire rope "cure-all". No one design of wire rope is suitable for all purposes. ¶ Roebling makes wire rope of a great variety of types and constructions, and therefore can supply a wire rope exactly suited to each particular requirement. ¶ The great stamina of all Roebling Ropes is primarily due to the quality of Roebling Wire. This Acid Steel Wire is renowned for its fatigue and wearing qualities. No better rope wire is produced. ¶ "BLUE CENTER" STEEL is the highest grade and is generally recommended for severe duty.

JOHN A. ROEBLING'S SONS COMPANY

AMERICAN STEEL & WIRE COMPANY WIRE ROPE

Specified for the Difficult Tasks

Close to a half million feet of American Steel & Wire Company Monitor Silver Strand Wire Rope was used in connection with the vast project which is portrayed in the illustration. This enormous amount of Wire Rope included many different grades and sizes—and its application to various types of equipment was carefully supervised by our engineers.

Subjected to gruelling punishment and abnormal operating conditions, our product established unrivaled service records. Wherever the going is tough—be sure to use American Wire Rope for dependable service.

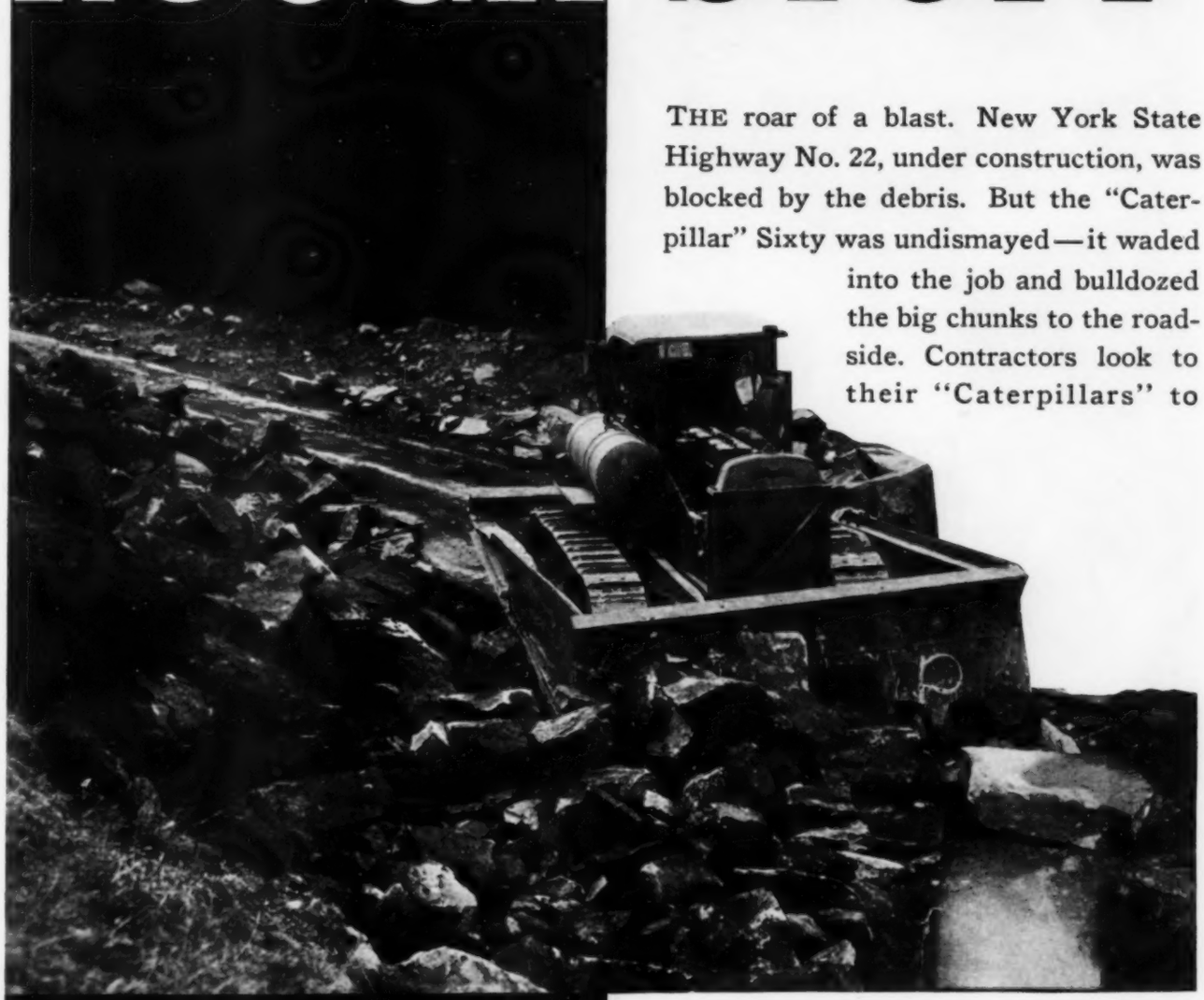
1831 — MORE THAN 100 YEARS of PROGRESS in WIRE MAKING — 1932

AMERICAN STEEL & WIRE COMPANY

208 South LaSalle Street, Chicago — SUBSIDIARY OF UNITED STATES STEEL CORPORATION — And All Principal Cities

Pacific Coast Distributors. Columbia Steel Company, Russ Building, San Francisco — *Export Distributors:* United States Steel Products Company, New York

ROUGH STUFF



THE roar of a blast. New York State Highway No. 22, under construction, was blocked by the debris. But the "Caterpillar" Sixty was undismayed—it waded into the job and bulldozed the big chunks to the roadside. Contractors look to their "Caterpillars" to tackle any phase of the work—the same tractor will push a bulldozer one day, pull a scarifier the next, haul wagons on a third. Endlessly useful—"Caterpillars" conquer bad weather and rough stuff.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)

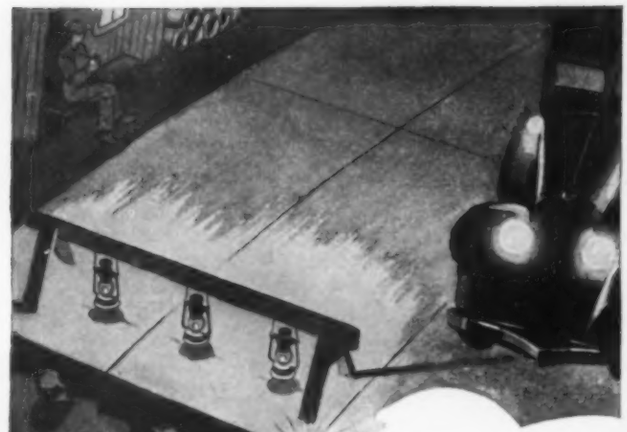
Prices — f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR



DIETZ
DEPENDABLE
LANTERNS AND TORCHES

As between lantems and torches, consider these points:

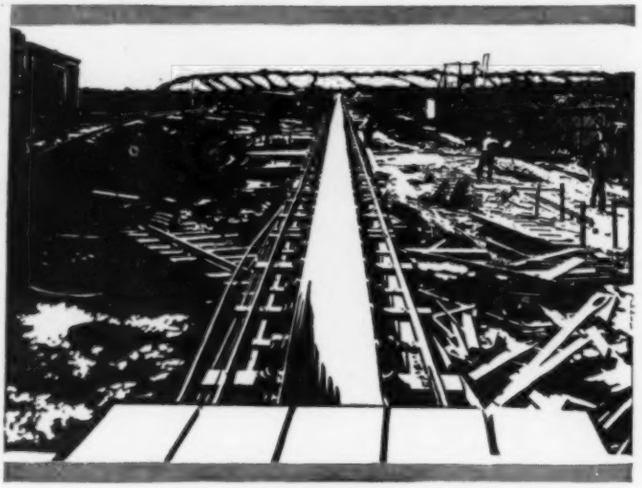
Dietz Red Lanterns are really flame protected torches with scientific combustion — unequalled for visibility and burning dependability — economical in cost and in fuel consumption. Being globed, they can shed a RED light — the ONLY color that means "DANGER."

All torches are much alike in appearance. The real difference is in the burner. Dietz All-Weather Burner makes Dietz Torches outstanding for quality'—'assuring highest reliability obtainable from an open flame. Torches are built for rough usage. They meet conditions when a red light is not important. Large wick and absence of globe increase fuel consumption above that of lanterns.

Lantems and Torches — you'll safeguard your purchase if you specify DIETZ make.

R. E. DIETZ COMPANY
NEW YORK
FOUNDED 1840
Makers of Lanterns for the World

DIXON'S



UNAFFECTED BY HEAT COLD OR MOISTURE

Makes any bearing run smoother, with less attention and with actual economy in lubricant and attention.

DIXON'S Graphite Cup Grease is used on bearings having grease cup, or pressure lubrication — regardless of the service, or bearing pressure.

Graphite puts a shiny, smooth finish on any bearing, prevents metal to metal contact and insures long wear with minimum maintenance.

Try it on any balky bearing. A sample will convince you quickly.

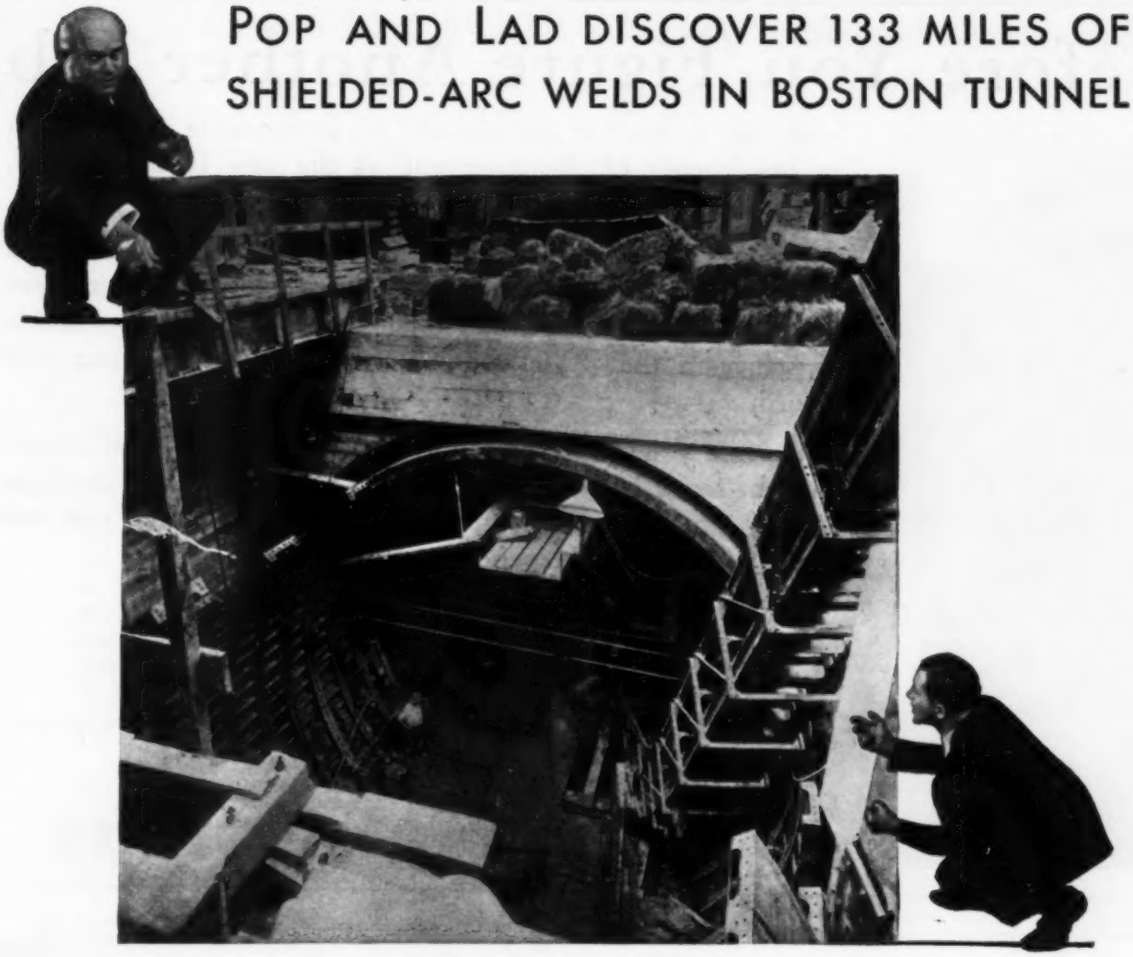
Other DIXON Products

Pipe Joint Compound
Waterproof Graphite Grease
Solid Belt Dressing
Flake Graphite
Silica-Graphite Industrial Paint

Joseph Dixon Crucible Co.
Jersey City GRAPHITE EXCELLENCE SINCE 1827 **New Jersey**
105 YEARS OF DIXON SERVICE

DIXON'S GRAPHITE CUP GREASE

POP AND LAD DISCOVER 133 MILES OF SHIELDED-ARC WELDS IN BOSTON TUNNEL



"Think of it! 133 miles of welds in this vehicular tube which goes under Boston Harbor to join Boston and East Boston.

"And every inch of weld made by the shielded arc process with Lincoln *'Stable-Arc'* welders and 'Fleet-Weld' electrodes.

"The 19,467 welded segments which formed the steel lining for this tunnel were fabricated by The Commercial Shearing and Stamping Co., Youngstown, Ohio.

"Say, tell me, why did they use Lincoln equipment exclusively on this job?"

"Because with Lincoln *'Stable-Arc'* welders and 'Fleet-Weld' electrodes each operator welded complete one segment per hour, which in lineal terms means 36½ feet of ⅜" fillet tack welds every 60 minutes, or an average of 11 lbs. of weld metal deposited per hour.

"With the *'Stable-Arc'* you get the full range of current with the higher voltage necessary for welding with the shielded arc.

"Lincoln will definitely guarantee your welding speeds and costs with a *'Stable-Arc'* welder. Find out now how much you can save by arc welding with Lincoln equipment. Write, wire or phone.

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World

W-20

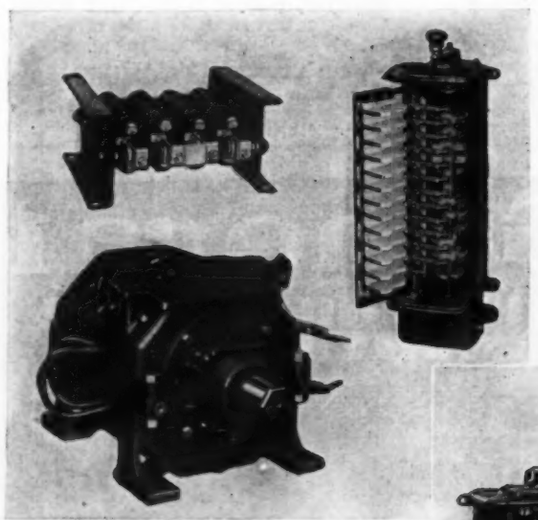
A LAGGING JOB IS A LOSING JOB!

The Dependability of G-E Equipment for Hoists Protects Your Profits

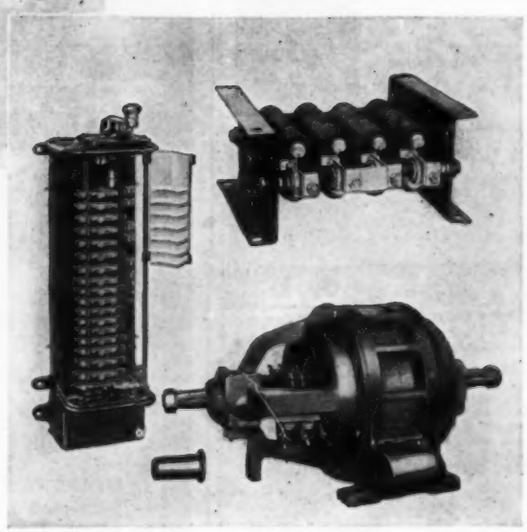
REGARDLESS of the type of structure you are putting up, hoisting equipment must never "lie down on the job"!

For this important service, General Electric offers you a wide range of dependable hoist drives—a-c. and d-c.—including complete combinations of motors, controllers, and reliable electrical accessories. Freedom from annoying and expensive delays is only one of the many reasons why you should install G-E equipment.

Remember, too, that no matter where you are working, when you specify General Electric equipment for your hoists, G-E offices, warehouses, and service shops are always near at hand. For permanent satisfaction, connect your hoist to a G-E motor, and specify G-E control for maximum flexibility and economy. General Electric Company, Industrial Department, Schenectady, New York.



If your power service is direct current, a G-E Type CO direct-current motor is always a good investment. Like the Type MTC (also illustrated) for alternating current, the Type CO may be had in a wide range of ratings for every need



If your power service is alternating current, you will do well to consider a G-E Type MTC wound-rotor induction motor and its necessary heavy-duty control. Here is an a-c. combination that has the "stuff"

For safety, convenience, and reduction of maintenance, consider the G-E Thrustor. For smoothness of braking control, nothing surpasses this important development. The Thrustor has also proved its value in scores of other applications, such as on valves, gates, etc.

200 588

GENERAL ELECTRIC

Don't

tear up the street

Bore the hole instead of trenching

Antiquated trenching and pipe-jacking methods of installing underground pipe are costly and wasteful. The watchword of today is "Save with Safety" and Hydrauger completely fulfills those requirements. Open trenches have cost many lives through traffic accidents; cut-up pavements have already cost far too many dollars. Hydrauger finds daily use in many of the more progressive and efficient cities throughout the country. Complete information is in our Bulletin; send for your copy today!

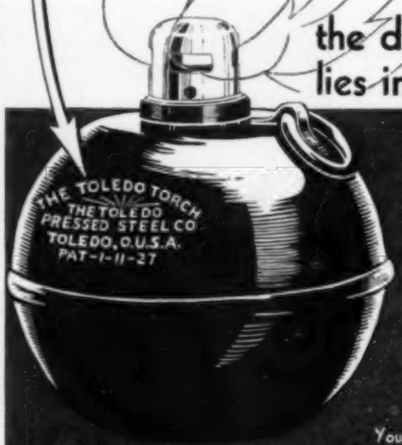
HYDRAUGER CORPORATION, LTD.
1298 Bryant Street, San Francisco, Calif.

HYDRAUGER
"The Mechanical Gopher"

---

this name on your torches means you have THE BEST

the difference lies in the burner



No other safety light can give you so dependable and economical protection . . . yet real TOLEDO TORCHES cost no more than the rest.

• • •

Your dealer can supply you.

USE THE TOLEDO TORCH NO OTHER SIGNAL MEANS SAFETY

The Toledo Pressed Steel Co.
TOLEDO OHIO

Save with Steel

Disc Your Oiled Roads

Baker Road Disc Cutting Up Oiled Road

BAKER ROAD DISC

Here's the answer to an old problem. The Baker Road Disc cuts up the oiled surface into small bits, gets below the bottom of "chuck" holes and slices up the bumps. Nothing else can break up the oil cake uniformly.

Four gangs of discs are mounted on a sturdy frame which can be lifted, lowered or tilted at will to suit conditions. All control is by hand hydraulic pump from one spot — positive, quick and easy without hand wheels or gears of any kind.

Send for descriptive matter now. See coupon below.

Baker Road Disc starting its cut

THE BAKER MFG. CO., 568 Stanford Ave. Springfield, Ill.

Another Unit of

BAKER TRACTOR EQUIPMENT

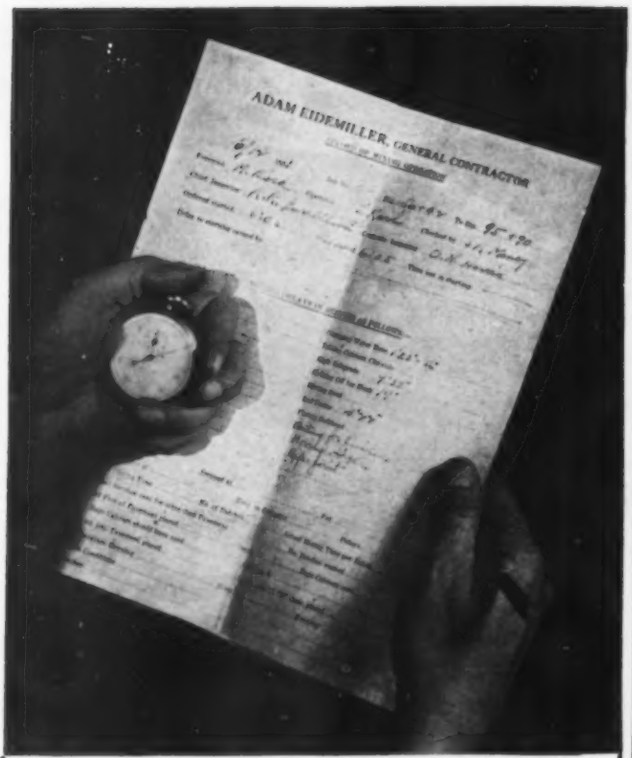
Send me information on:

BAKER ROAD DISC ☐
BAKER MANEY SCRAPERS ☐
BULLDOZERS ☐

Name .....

Address .....

568



THE STOP-WATCH

Checks Losses!

Checks Up on Profits!

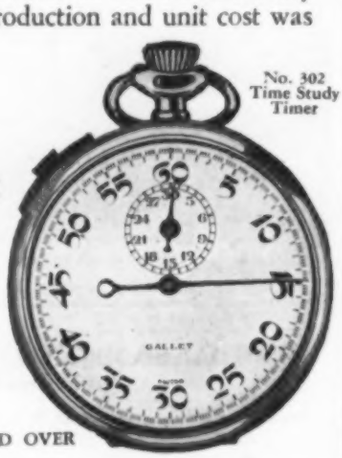
■

Read this excerpt from a Report by the U. S. Bureau of Public Roads:—

"On two Wisconsin jobs, daily production studies were made. . . . By stop-watch studies of key equipment for two or more hours every day, the effect on production and unit cost was determined"

For Economy—
For Efficiency—
Use a Stop-Watch!

GUINAND
and
GALLET
STOP-WATCHES
ARE
STANDARD THE WORLD OVER



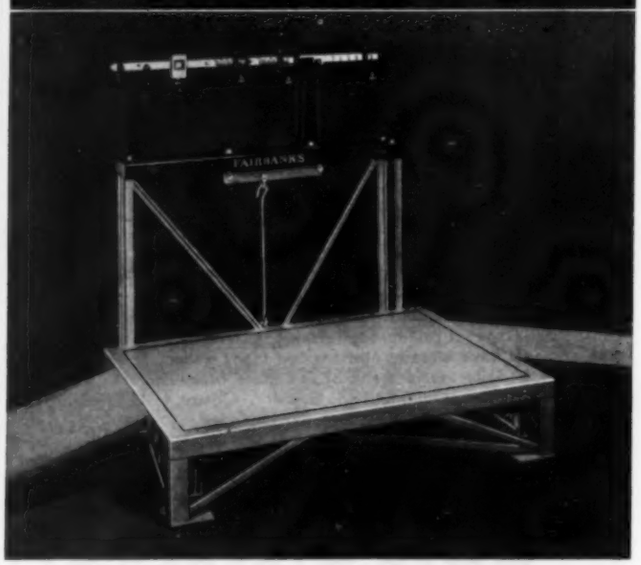
No. 302
Time Study
Timer

JULES RACINE & CO., 20 West 47th St., New York, N. Y.
Kindly forward catalog CM-6 on Stop-Watches for Road Use.

Name .....

Address.....City and State.....

SURE...you can have *accurate control* of the mix!



THE specifications can be equally as exacting on small jobs as on large ones. But either way, you must meet them. And the *only* way you can accurately meet physical requirements "specs" is by accurately controlling the aggregates going into the mix.

A Fairbanks Wheelbarrow Scale is so easily portable that it pays to use it on the smallest job. And it's husky enough to stand day-in-and-day-out service on the largest job.

Figure your proportions and then weigh them out on this scale and you need not worry about acceptance on the specifications.

With the Fairbanks Wheelbarrow Scale you can have this assurance without an undue penalty to time. The low platform, and easily read indicators, permit quick, convenient weighing.

Remember, an error in mixing may cost you far more than one of these scales. Write the nearest Fairbanks office for full information.

FAIRBANKS, MORSE & CO.
900 S. Wabash Ave., Chicago, Ill.
And 40 principal cities—a service station at each house.

● ● ●

Wheelbarrow Scale fitted with "over and under" indicator. When the correct load for which the scale has been pre-set, is placed on the platform, the indicator points to zero. Incorrect weight is shown on "over" or "under" side. The same scale may be fitted with battery and bell. Bell rings when proper load is on scale.

Fairbanks Scales

Preferred the World Over

5746-SA31.8

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD

Positions Wanted, 5 cents a word, minimum $1.00 an insertion, payable in advance.

Positions Vacant and all other classifications 10 cents a word, minimum charge $2.00.

Proposals, 50 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 inch.....$6.00
2 to 3 inches..... 5.75 an inch
4 to 7 inches..... 5.50 an inch

Other spaces and contract rates on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A. M. ON THE 2ND FOR THE ISSUE OUT THE 9TH OF THE MONTH C.M.

ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.

▼ ▼ ▼

SEARCHLIGHT SECTION
Classified Advertising

On this Wisconsin job, it was

CITIES SERVICE

for tractors, graders, cranes, trucks and shovels

When Milwaukee Electric Railway & Light Company elevated its tracks from Milwaukee to Kenosha, the Kenosha County section of the job was practically 100% Cities Service.

A. E. Bounsall, who had the contract for the fill, used Cities Service products in all equipment—which included Holt Tractors; Holt and Wehr Graders; Diamond-T, International, Mack and White Trucks; Bucyrus-Erie Cranes; and Bucyrus-Erie and Rex Shovels.

Viaducts were built by Tully Construction Company and Lindeman Construction Company, both of whom used Cities Service products exclusively, as did Mackie Thomson Tamm, Inc., Engineers and Construction Contractors.

Contractors everywhere are using Cities Service petroleum products because they furnish perfect lubrication for equipment under all conditions.

"IF IT'S CITIES SERVICE—IT HAS TO BE GOOD!"

ities Service Oil Company • Cities Service Refining Company • Crew Levick Company • Louisiana Oil Refining Corporation
Lindsay-McMillan Company • Winona Oil Company • Inter-State Oil Company • C. H. Lockwood Oil Company

"Are the men more careful ... or are these *bags* better?"

"YOU'VE noticed that, Chief! I checked up on it a few days ago. I think the men are a little more careful of *everything*, because they're all trying their best. But I *do* know that the bags are very much improved!

"I have a friend in one of the Kraft paper mills supplying the stock for these bags. I understand from him that there's no comparison between the paper they produced three years ago and now ... it's so much better now.

"And, when the Multi-Wall *Sewn* Paper Bag factories worked out of their 'semi-hand' stage, and *mechanized* all the way through, they insured their jobs just as we have ours ... with machines-that-can't-miss instead of 'variable' human hands.

"Besides, in the cement mills, packing machines and handling methods have all been ... Chief, am I making a public speech or something?"

A series of timely bulletins is being mailed to Building Contractors the country over. To insure that yours come to you promptly, send your name and address to The Associated Manufacturers of Multi-Wall Sewn *Paper Bags, 60 E. 42nd St., New York, N.Y.*

Public speech or not, engineers-in-charge appreciate assistants checking up. The check-up, by the way, usually results in a decision to make the Multi-Wall Sewn *Paper Bag the container for the delivery-to-job of cement and similar rock products ... and particularly in the case of the latter-day special, fine-ground, high-early-strength cements.*

The Associated Manufacturers of
MULTI-WALL *SEWN* PAPER BAGS
60 East 42nd Street, New York, N.Y.

ARKELL AND SMITHS
Canajoharie, N. Y.

BATES VALVE BAG CORP.
60 E. 42nd St., New York, N.Y.

BEMIS BRO. BAG CO.
Peoria, Ill.

THE JAITE COMPANY
Jaite, Ohio

THE THOS. PHILLIPS CO.
Akron, Ohio

THE RAYMOND BAG CO.
Middletown, Ohio

TAGGART BROS. CO., INC.
60 E. 42nd St., New York, N.Y.

UNIVERSAL PAPER BAG CO.
New Hope, Pa.

THE VALVE BAG CO.
60 E. 42nd St., New York, N.Y.